

CLIO MEDICA

# INTERNAL MEDICINE

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SIR HUMPHRY ROLLESTON







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# CLIO MEDICA

A SERIES OF PRIMERS ON THE  
HISTORY OF MEDICINE

EDITOR: E. B. KRUMBHAAR, M.D.

IV  
INTERNAL MEDICINE

BY  
SIR HUMPHRY ROLLESTON, BART.

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CLIO MEDICA

# INTERNAL MEDICINE

BY

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## EDITOR'S PREFACE

This little volume is one of a series of hand-books which under the general title of "Clio Medica" aims at presenting in a concise and readable form a number of special phases of the long and complex history that underlies the great edifice of modern medical science.

Since the times of the Aldines and Elzevirs, small easily portable booklets have been popular with the intelligent reader. Today books that add no appreciable burden to the coat pocket are real helps to the busy worker or student in gaining ready access to considerable worth-while reading. Such booklets, too, seem peculiarly appropriate for a new line of approach to such a subject as the History of Medicine from a different point of view than has hitherto maintained. From the very nature of this subject, when treated in a general way, it has thus far appeared either in ponderous tomes or, if in smaller volumes, in such scanty garb that almost no details of the costume are discernible. Then, too, the strictly chronological method of approach, with emphasis on prominent individuals, becomes almost a necessary form of treatment in the comprehensive general histories. The searcher for knowledge of the history of some small branch of the subject—a specialty, say, or the progress of medicine in this or that country—is thus forced to hunt, often painfully with help of index and marker, through the pages of the larger book or books, to be rewarded with a necessarily disconnected and usually incomplete presentation.

## EDITOR'S PREFACE

Our hope is that the series "Clio Medica" will obviate these difficulties. Conveniently small and inexpensive, yet prepared by recognized authorities in their chosen field, each volume will aim to present the story of some individualized phase of the history of medicine in such compact, connected, convincing and reasonably complete form that the medical undergraduate, the specialist, the busy general practitioner and the "intelligent layman" will all be attracted to a few hours' reading, which in many cases will doubtless prove the introduction of an awakened interest to a more comprehensive study.

An increasing interest has recently become manifest in the history of medicine in the English speaking as well as in other countries, as is shown by the successful formation of new societies, journals and institutes for the study of the subject. The times, then, seem auspicious for this venture. Several volumes of the series are already in course of preparation; as these materialize more will be undertaken with the possibility of a large number being attained. We bespeak the support of our colleagues and friends and pray that the Goddess whose name we have used to designate our series may deign to foster the undertaking!

E. B. KRUMBHAAR.

PHILADELPHIA, PA.

## AUTHOR'S PREFACE

In this brief survey of the history of internal medicine, meaning thereby the old-fashioned term physic and not the whole of the healing art, it has often been difficult to decide how much to include or omit in order to preserve a due proportion. In the main the matter is of course arranged chronologically, but in a number of instances the progress of a new advance is carried on beyond the time of its origin. In some places it has been necessary to touch, though very shortly, on the position of anatomy, physiology, pathology, and surgery, subjects treated in other volumes of this series, in order to explain important milestones in internal medicine. Due acknowledgment must be made to works of the late Sir William Osler, the late Sir Clifford Allbutt, Dr. Charles Singer, and more especially to that never-failing source of reference, Colonel Fielding H. Garrison's "Introduction to the History of Medicine," for constant help and guidance.

HUMPHRY ROLLESTON.

Cambridge, Eng.,  
*July, 1930.*





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# CLIO MEDICA

## INTERNAL MEDICINE

### INTRODUCTION

A COMPLETE knowledge of a science is impossible without an acquaintance with the history of its development, which has an educational value in supplying a clear idea of how its present position has been reached, by showing how pitfalls and fallacies can be avoided, and by indicating fresh avenues for investigation. In Napoleon's words, "the only guide to the future is the past." A correct perspective of medical history should insure that principles established long ago shall be remembered; though it must be admitted that in a number of instances an advance has been made or a new conception originated and yet has failed to attract any notice until rediscovered many years later. Further, a knowledge of history helps to discount fads and fashions of the moment, and breeds humility by recalling how much our predecessors accomplished in circumstances so much less favorable than our own for research.

The history of medicine has three aspects: the first is the general study of philosophy, chiefly of interest in relation to the study of the mind and the evolution of ideas; the second deals with the lives and works of medical men, which touches the first on the one hand and biography

and bibliography on the other; and the third is concerned with the diseases and epidemics of the past, perhaps the most practically useful of them all. There is some danger that medical history may deal too much with the lives and doings of leaders of thought and pioneers and too little with the progress of ideas, for advances often come from a number of workers one of whom is a little in advance of the other, the time being ripe from the accumulation of knowledge for a discovery which indeed is sometimes made almost simultaneously by more than one worker. On the other hand medical biography is an attractive and simple way of presenting historical data, and the study of the published works (bibliography) of the prominent figures of the time, when combined with that of their individuality, provides in bio-bibliography much in the way of a general survey.

## CHAPTER I

### ANCIENT MEDICINE

From the earliest times mankind must have experienced injury and disease and have made attempts at prevention, relief or cure, under the influence of the instinct of self-preservation, or of parental feelings and sympathy for others. The lessons thus gained by experience crystallized into empirical knowledge. In prehistoric times the causation of disease by natural agents was not recognized, and human agencies, such as death in battle, were explained as due to the activity of sorcerers. To counteract these hostile actions appeal was naturally made to magic and elementary religious procedures, so that primitive medicine, magic, and religion became inseparably connected. The primitive medicine man (Shaman) acted on these principles, and on the idea of demonic possession, strove to coax, charm, or drive the evil spirit out of the sufferer's body by his terrifying get-up, noises, and treatment which no doubt might be effective against hysteria, or by charms and incantations, to remove the effects of a spell. The notion that the demon and the disease could be transferred from the patient into a scapegoat, the transference of disease, was also a commonly held concept. But primitive medicine was more than mere superstition and mysticism; experience built up a considerable knowledge of the use of herbs and of rough surgery, and "wise women" undertook midwifery.

*Mesopotamian and Egyptian medicine*, already considered in the first volume of this series, are



briefly referred to here, as of great importance in the early beginnings of the history of clinical medicine. Civilization in Mesopotamia began between B.C. 4000 and 3000 among the Sumerians, whose semitic conquerors the Babylonians and Assyrians carried it on to a state of further development. As in other young civilizations, the priest was the medical authority, and astrology and divination from inspection of animals, chiefly the sheep's liver (hepatoscopy), largely governed the outlook on the future and the prognosis of disease. The influence of numbers, and especially the evil effects of 7, was manifest in the methods of practice. Disease was regarded as something of external origin, an evil spirit entering into the body, the expulsion of which by incantations, charms, applications and drugs resulted in a cure. Diseases of different parts of the body were recognized and described; thus mental diseases were due to the magic of witches and demons. The blood was the vital principle, and the liver the seat of life, the soul, mind, and emotions.

*Egyptian Medicine.* Our knowledge of the practice of early Egyptian medicine is chiefly derived from papyri (Edwin Smith, *ca.* B.C. 1700; Ebers, *ca.* B.C. 1550, *et al.*). Embalming, which provided a certain amount of information about the viscera, even though it was put to little practical use in medicine, so thoroughly familiarized the Egyptians with the idea of opening the dead body that the Greeks in the Alexandrian School (B.C. 300) were allowed to dissect the human body at a time when popular feeling made this impossible in all other parts of the world. Egyptian medicine originated

in magic, which always played its part even as practice became more rational. Monthly purgation was a custom, as the Egyptians held that diseases were due to the ingested food. Underlying the practice of medicine was the belief that disease was due to deficiency of a vital substance and accordingly the rational treatment was to give blood or something of the same color. Many diseases that we can identify from the descriptions today were described in some detail and animal, vegetable and mineral compounds recommended freely.

Long before the time of Hippocrates medicine became quite stationary in Egypt, thus resembling what occurred in Chinese medicine; but the wisdom of the Egyptians was conveyed by the Phoenicians to Greece where it became scientific under Hippocrates, and so returned later to the Alexandrian School. In the fifth century B.C. when Egyptian medicine had degenerated there was, according to Herodotus (B.C. 484-425), a high degree of specialism among the Egyptian medical practitioners, each strictly confining his attentions to one disease; but this description does not correctly represent the condition of practice at an earlier date, before medicine passed entirely into the hands of the priests and thus contrasted with the conditions subsequently seen in Greece.

*Jewish Medicine.* The Jews clung to the Babylonian and Assyrian conception of disease as due to demonic possession. The chief contribution of Jewish medicine is the origination of social hygiene and medical jurisprudence; indeed their insistence

on the prevention of disease anticipates the present ideal of medicine.

*Hindu Medicine.* Hindu medicine, derived from Mesopotamia, has been divided into three periods: (1) the Vedic, before B.C. 800, primitive and in the bonds of superstition, (2) the long Brahminical epoch (B.C. 800–1000 A.D.) when medicine was in the hands of the priests; (3) the Arabian period from 1000 A.D., the result of the Muhammadan conquest.

Although anatomy was at a very low ebb in India as dissection was prohibited, surgery attained a high standard. Bhava Misra (A.D. 1550) of Benares is said to have mentioned the circulation of the blood and prescribed mercury for syphilis.

*Chinese medicine* developed very early, but its progress became arrested so that now with forty centuries of experience it is comparable with that in Europe in the sixteenth century. Four periods have been described: (1) the ancient or legendary, from the dawn of history to B.C. 1000 when medicine was under sway of the priests. Massage was practiced from the earliest times, and the methods of acupuncture were greatly elaborated. (2) The long historical or classical period, beginning with the Chow and ending with the Tang dynasties, from B.C. 1000 to A.D. 960. In the fifth century B.C. the circulation of the blood was conjecturally recognized and great importance was attached to the characters of the pulse. Sanitation and hygiene were well advanced at this date. (3) The medieval or controversial period, 1000 to 1805 A.D. Inoculation against smallpox was known to the Chinese in 1022 A.D.



Medical schools were established in 1068 A.D., but passed into abeyance about 1300 A.D. Medical treatises multiplied, and the "Synopsis of Ancient Herbals" contained 71,096 formulas and 1892 substances. Accurate descriptions of syphilis with recognition of its hereditary transmission were given in the seventeenth century. (4) In the modern or transitional period, beginning in 1805, with the invasion of Western medicine, there was a struggle between the old and the new. Jennerian vaccination was introduced in 1806, and in 1899 Japanese medicine became popular in China. In 1921 the Rockefeller Foundation opened the Union Medical College and Hospital at Peking and this, the finest medical school in the Orient, has greatly increased the improvements which medical missionaries had been laboring at for years.

*Early Japanese medicine* was like that of other primitive nations until B.C. 96 when it came under the influence of Chinese medicine. In the eighth century of the Christian era there were medical schools throughout Japan, and a manuscript of 982 A.D. shows that dissection had long been practiced. In the middle of the sixteenth century European medicine first reached Japan with the arrival of the Portuguese and St. Francis Xavier. In the middle of the eighteenth century Dutch influence was dominant; it is now essentially German in character.

## CHAPTER II

### GREEK MEDICINE

*Pre-Hippocratic Medicine.* Apollo, the original god of healing, cured the Olympian gods by means of the peony root, hence his name "the Paeon" and the designation "the Sons of Paeon" for medical men. His reputed son Aesculapius (Asclepius) was a physician at the time of the Trojan War, B.C. 1000, and soon afterwards was made the god of medicine. The daughters of Aesculapius Hygeia and Panacea attended the temples and looked after the sacred harmless snakes which were afterwards kept in a kind of well in the rotunda, a building attached to the temples.

The serpent, a symbol probably of Minoan origin, was sacred to Aesculapius, who is usually represented with a snake coiled round a rough piece of wood or merely round his arm. The snake-root staff of Aesculapius has a snake coiled round a rod, and should be distinguished from the caduceus or herald's wand of Mercury, the Messenger of the Gods, which has two snakes entwined round a rod with, in addition, two wings at the top. In the Great War this confusion was shown by the medical officers of the Allied armies wearing the wand of Mercury as their badge. The snake was much used by ancient physicians in their prescriptions and was regarded as a symbol either of prudence, just as the cock and the dog, signifying vigilance, were often represented with Aesculapius, or of life from the belief that the souls of the dead, especially of the young, passed into serpents. Numerous

snakes were kept in the Asclepieia or temples, which began to be erected about B.C. 600 and numbered more than two hundred, in honor of Aesculapius (Asclepios); the snakes were supposed to be imbued by, or to be emanations of, the god.

The best known Asclepieia were at Trikka, Epidauros, Cos, Cnidos, and Pergamos, and became resorts for the cure of disease by the rite of "incubation" practised by the priests, a method with a precedent in ancient Egypt. After listening to the priest's recital of the wonderful cures of temple-treatment, and after due prayers and sacrifices to Aesculapius, the patient was bathed in the water of the temple spring, massaged, and anointed in preparation for the temple sleep; any dream was interpreted into advice by the priest, who in the event of sleep not supervening appeared as the god and delivered the necessary directions. On recovery, which must be ascribed mainly to suggestion, the patient made thank-offerings to the temple, sometimes in the form of wax, silver, or gold models of the affected part, and a tablet with an account of the disease and its miraculous cure. The character of the treatment, whether scientific or charlatan, has given rise to discussion; Walter Pater argued for the activity of the Asclepiadae in preventive medicine. The view that the Asclepieia were the sanatoria of the period has been contested by P. Cawadias who discovered the sanctuary of Epidauros in 1881. The religious medicine in the temples and the rational medicine practised by the Asclepiadae thus were concomitant, just as Christian Science and orthodox medicine co-exist at the present day.



Greek medicine, though largely derived from that of ancient Egypt by means of the sea-faring Phoenicians, differed from it, in spite of what has been said about the treatment by incubation, in being free from the domination of the sacerdotal caste; indeed from Homeric times the medical practitioners and the priests were distinct. But the philosophers, especially Thales of Miletus (B.C. 638-544), Pythagoras of Samos (B.C. 580-489) who founded the Italian school of philosophers of Crotona, originated the doctrine of the mystic power of numbers, and was responsible for the Pons Asinorum (Euclid, Book i, 47), Empedocles (B.C. 490-430) of Agrigentum who was a poet and also described the labyrinth of the internal ear, and Alcmaeon of Crotona (ca. B.C. 500) who was perhaps the earliest Greek anatomist, having dissected the eyes and ears of animals and discovered the optic nerve and the Eustachian tube, took medicine as their province. For example the city of Silenus in Sicily was attacked by a pestilence ascribed to the water supply, and Empedocles when consulted carried out draining operations which swept away the stagnant water and so, presumably by removing the breeding places of the malaria-carrying mosquitoes, restored the health of the city. Up to the time of Hippocrates medicine was included in philosophy.

*Era of Hippocrates.* The period of Hippocrates, the "Father of Medicine" was the starting point of scientific medicine not only in Greece but in Europe, and sharply marks the separation between the preceding eras of myth and superstition on the one hand and the advent, at any rate for a



time, of clear thinking based on sound principles and observation on the other hand.

Hippocrates (B.C. 460–390?) lived in the golden age of Greek history—the period of Pericles, the poets Sophocles, Euripides, Aristophanes and Pindar, the philosophers Socrates and Plato, the historians Herodotus and Thucydides, and of Phidias. He was the son of Heracleides and the second of seven medical men of the same name, and was born in the island of Cos of an Asclepiad family tracing or at least claiming descent from Aesculapius. He no doubt had the advantage of a critical acquaintance with existing aspects of the healing art as set forth in the tablets of the Coan temples; he studied at Athens, but of his life history very little is accurately known; even the date of his death is uncertain, as his age has been stated to have been between eighty-five and a hundred years.

Of the large number (about sixty) of the books included in the Hippocratic Canon or “Corpus Hippocraticum” about a fourth are probably genuine, others are by his predecessors, by his contemporaries and pupils, in fact the remains of the library of the Hippocratic School at Cos; some are entirely spurious. The genuine works of Hippocrates, written in a concise style like those of his contemporary Thucydides, include the famous “Aphorisms,” “Airs, Waters and Places,” the earliest medical account of climatology, geographical medicine and anthropology, the prognostic, epidemic diseases, diet in acute disease, wounds of the head, dislocations, fractures, and ulcers. One of the most famous Aphorisms may be quoted for its comprehensive nature:

"Life is short and Art is long; opportunity fleeting; experiment dangerous and judgment difficult, yet we must be prepared not only to do our duty ourselves, but also patient, attendants, and external circumstance must co-operate." Some of Hippocrates' aphorisms were subsequently reproduced in the "Regimen Sanitatis" of Salerno (*vide* p. 30).

He attached great importance to prognosis and considered that if cure was impossible the best physician was he who could give the most accurate prognosis. The treatise on "Epidemic Diseases" contains the clinical accounts of forty-two cases characterized by scientific honesty and by absolute freedom from any trace of self-advertisement or quackery, for 25 per cent of them proved fatal; it is astonishing that this plan of recording details of individual cases lapsed for two thousand years until Sydenham's time, with the exception of some cases in Galen's writings. Hippocrates did not carry out experiments on animals, but he made many original observations, and to some of them: succussion, clubbed fingers, and the facies of acute abdominal disease, his name is attached; he directed attention to clinical observation and away from theoretical considerations, thus removing medicine from the realms of philosophy. Further, by insisting that all diseases, including epilepsy "the sacred disease," have a natural cause he separated medicine from its associations with priestcraft, superstition, and largely from philosophy and hypotheses.

His medical treatment was simple and relied much on the inherent curative power of nature

(*vis medicatrix naturae*), which the medical man should imitate and if possible assist, and invoked the help of fresh air, good and suitable diet, water baths, and purgation. This method of general treatment, of prognosis, and of ensuring that the medical man should do no harm, which was subsequently described by Asclepiades of Bithynia (B.C. 124) as "a contemplation of death," contrasted with that of the Cnidian School which aimed at diagnosis and specific therapy. His surgical treatment, especially in view of the almost complete absence of knowledge of human anatomy, is wonderfully modern and contains the rudiment of asepsis. The humoral theory, namely that health is due to equilibrium, and disease to a disturbance of the proper proportions of the four humors, blood, phlegm, yellow and black bile, originated in the Hippocratic Corpus, in "The Nature of Man" which has been ascribed to Polybus, Hippocrates' son-in-law. Hippocrates recognized that diseases might be due to visceral lesions brought about by the external factors of climate, seasons, extremes of temperature, fatigue, emotions which were included under the term "constitutions" and much expanded by his British successor Sydenham in the doctrine of "epidemic constitutions."

*The Hippocratic Oath*, though probably an ancient temple oath of the Asclepiadae and not a genuine Hippocratic document, for some of the maxims of the ancient Egyptians resemble it, forms the basis of medical ethics and finds an echo in the formal declarations made on graduation at some existing seats of learning. It underwent many modifications in course of time at



the hands of scribes; there were two versions, the pagan and the Christian, and both, but the latter especially, had many variants. The Christian version omits all clauses tending to encourage a trade unionism, and W. H. S. Jones, who has collated thirty manuscripts, therefore concludes that it was written in the early days of Christianity before the benevolent communism of its first followers faded. The pagan version contains the clause about operations, which has two possible interpretations with a very distinct difference in their significance, namely "I will not operate for stone," and "I will not operate, not even for stone"; it has been suggested that this clause was subsequently added to suit the prejudices of some physicians. The *Corpus Hippocraticum* was amended and modified by annotators much more freely than other classical masterpieces as it was regarded as a textbook important for the sense, rather than for its verbal expression.

*Post-Hippocratic Greek Medicine.* After Hippocrates Greek medicine fell under the influence of the sect rather unfortunately known by Galen's name of the *dogmatists*, for, as R. O. Moon points out, the "theorists" would be a better title. Their philosophic and speculative attitude was due to the guidance of Diocles (B.C. 400), Praxagoras (B.C. 340) of Cos, and Plato. Praxagoras drew a distinction between the arteries which pulsated and contained air and the veins which contained blood. The dogmatists, however, tried to found medicine on etiology and physiology and so far built in the right direction, but the foundations were very scanty and those provided by Plato's famous dialogue, the "Tim-



aeus," which became their textbook of philosophy, were often rather fantastic.

Aristotle (B.C. 384-322) of Stagira was the son of an Asclepiad, Nicomachus, and, after a long discipline under Plato, founded the peripatetic school of philosophy. No man has ever so dominated and advanced science as a whole; he was one of the founders of the inductive method and the first to set the example of organized research. Though the greatest biologist for two thousand years, an embryologist, a "vitalist," and the describer of five hundred animals, he never dissected the human body. The heart he regarded as the source of "innate heat," thought, and sensation, and he denied that the brain was the organ of mind; this was contrary to the teaching of Plato, and Singer suggests that Aristotle came to this conclusion as the result of finding that the brain was insensitive experimentally; he did not distinguish between the arteries and veins, both of which he thought contained blood, the pulse being due to ebullitions caused by the "innate heat." Theophrastus (B.C. 372-287) of Eresos, the pupil of Aristotle, "created the science of botany and made possible the pharmacologists of a few centuries later" (Osler).

Greek medicine spread to other parts of the world and thus more or less definite periods of medicine may be described, namely the school of Alexandria, Greek medicine at Rome, Byzantine medicine, the remarkable revival at Salerno, and the Arabian or Moslem period.

*School of Alexandria.* At the beginning of the third century before Christ the intellectual center of the world moved from Athens to Alex-

andria. Its medical school, inspired by Greek medicine, was noteworthy for its early leaders Herophilus and his junior contemporary Erasistratus. Herophilus, born at Chalcedon, started anatomical dissection, described a number of organs and parts of the body, and has therefore been called the founder of systematic anatomy; he paid special attention to the brain, its membranes, and the nerves, his name remaining attached to the torcular Herophili. As a pupil of Praxagoras of Cos he was familiar with the pulse, to which there is very little reference in the Hippocratic writings, and gave an account of the dicrotic pulse (the goat-like pulse, referring to the double heave of a goat's back when rising from the ground).

Erasistratus (B.C. 310-245) of Chios has been described as the first scientific physiologist, was a rival of Herophilus and attached to the Cnidian school, condemned mystery, though he elaborated the theory of the "pneuma," and was an epicurean or in modern language a materialist. Like Herophilus, he was later accused, probably on insufficient grounds, of dissecting living criminals. He wrote a work on hygiene and thus was a pioneer of preventive medicine. His addition to the knowledge of the circulatory system was the description of the aortic and pulmonary valves and the chordae tendineae and their mode of action. He counted the pulse with a waterclock and, recognizing the pumping action of the heart, was near the discovery of the circulation; but he believed that the arteries contained air which was absorbed from the lungs, changed in the heart into "the pneuma" or vital spirit, and then

carried all over the body; the veins, he admitted, contained blood. Like Aristotle, he also imagined that there were synanastomoses or communications between the arteries and the veins; but this was only to explain why an incised artery gave out blood. He was therefore driven to the elaborate and certainly ingenious hypothesis, which Praxagoras of Cos also professed, that when an artery was opened the "pneuma" or air escaped, and to prevent the vacuum abhorred by nature, normally closed communications between the arteries and veins opened and allowed blood to fill the wounded artery. Fragments only of the works of Herophilus and Erasistratus, who are said to have observed the lacteals, have come down to us. The Alexandrian school maintained the doctrine of the four humors, which obscured medicine in the Dark Ages.

In opposition to the dogmatists the school of the *empirics* arose at Alexandria about B.C. 280, under the influence of Philinus of Cos and Serapion of Alexandria, pupils of Herophilus and Erasistratus. Heraclides (*ca.* B.C. 230), the most notable member of the sect, was the first to point out the indications for the use of opium, which, though probably employed from very early times, is mentioned once only in the Hippocratic Corpus. Neglecting anatomy and etiology and detesting formal reasoning, the empirics believed only in the teaching of experience and concentrated on the cure of the symptoms of disease, and with this object in view not only employed but tested many drugs.

In spite of its brilliant beginning the Alexandrian school of medicine failed to keep pace

with the active departments of literature, mathematics and astrology; when Egypt became a province of the Roman Empire in B.C. 50 the scene of progressive medicine moved to Rome, and in the second century A.D. the creative period of Greek medicine came to an end.



## CHAPTER III

### GREEK MEDICINE IN ROME

With the fall of Corinth (B.C. 146) interest in the history of medicine passes to Rome where previously the healing art had, at any rate from a professional aspect, been practically non-existent. The pursuit of medicine, being beneath the dignity of a *Civis Romanus*, became the perquisite of the Greek colony. Asclepiades raised the social position of medical men, Celsus provided an attractively written record of medicine, Aretaeus the Cappadocian in the second century was a clinical observer on Hippocratic lines, Dioscorides in the first century A.D. established *materia medica* for many centuries, but the outstanding figure was Galen whose influence dominated medicine for more than a thousand years—until the publication of Vesalius' "*De Fabrica humani Corporis*" (1543).

*The Methodic School.* Asclepiades (B.C. 124-40) of Bithynia was the first to employ humane methods in the treatment of the insane, thus anticipating Pinel in Paris and Tuke in England in the eighteenth century; he has been called by Withington "the Father of fashionable physicians" in preference to the title of "the Hippocrates of chronic disease" previously suggested for this successful practitioner in Rome. He was a strenuous opponent of the dogmatic school and followed the atomistic doctrines of Democritus (B.C. 460-360), "the laughing philosopher," and Epicurus (B.C. 342-270) that the body is made up of atoms with spaces or pores between. With or

through his pupil, Themison of Laodicea (*ca.* B.C. 50), he founded the school of Methodism. This sect was intermediate between the dogmatists and the empirics, and, while based on the atomistic doctrine, practically confined its attention to the pores. Neglecting causes and symptoms, the methodists divided diseases into (1) those due to constriction of the pores, to be treated by methods that would relax them, and (2) those in which the pores were relaxed, to be treated by constricting remedies; thus recalling the opposite doctrine of homeopathy in the eighteenth century that "like cures like." The methodic hypothesis underwent modification and subsequently revivals through many centuries. Thessalus (*ca.* 60 A.D.) of Tralles, though a charlatan, was actively connected with this sect, and advocated the "alterative" method whereby the state of the whole body could be changed; later Soranus of Ephesus, eminent as a gynecologist, obstetrician and surgeon, while retaining the title, departed from the precepts of the methodic school by attaching importance to anatomy and diagnosis. F. Hoffmann (1660–1742) regarded diseases as due to atony or spasm; the Brunonian theory (1750), advocated by the "disputatious and disreputable" John Brown (1735–88) of Edinburgh, explained sthenic and asthenic diseases as due to excessive or deficient stimulation of the "excitability" of the body, and treated the symptoms by remedies calculated to produce the opposite effect, for example the much commoner asthenic diseases required alcohol. Broussais (1772–1838) of Paris, believing that disease was due to irritation and heat,

vigorously practised a starvation and leeching line of treatment.

*Aulus Cornelius Celsus* (B.C. 25–50 A.D.) is generally stated to have been a member of a noble Roman family, the gens Cornelia, and not a medical man, for it was only foreigners, freedmen and slaves who took up medicine as a profession. He was an encyclopedic writer on agriculture, war, rhetoric, philosophy and law, as well as on medicine, human and veterinary, though his medical works are the only ones extant. His “*De Medicina Libri Octo*,” the fine literary style of which probably accounted for its popularity, was discovered at Milan in 1443 and was one of the first medical books to be printed (1478); he has therefore been called “*Cicero medicorum*,” “the creator of scientific Latin,” and “the Roman Hippocrates.” His writings kept a broadminded mean between the opinions of the dogmatists and empirics, and are of great historical value, for, like Pliny’s “*Natural History*,” they contain an account of medical practice in the time of Tiberius when Roman civilization was at its acme, and both deal with disease in the upper classes, and refer to the existence of infirmaries or hospitals. It has been thought that Celsus merely translated from the Greek an existing work by a contemporary physician of the first century A.D., and there has been considerable discussion as to the identity of the original writer; in 1913 Max Wellmann argued that it was Cassius, and in 1925 that it was Tiberius Claudius Menecrates. In the early phases of medicine, that is up to the renaissance, there was, as Sudhoff insists, a tendency for the name



of the real author to become lost in that of the translator or compiler. Celsus drew his materials mainly from the Alexandrian school, especially Erasistratus, but appears to be the first to mention the four classical cardinal signs of inflammation, viz. *tumor, rubor, calor, dolor*.

*Claudius Galen* (130–201 A.D.), born at Pergamos in Asia Minor, exerted a longer and more dominating influence over medicine than any of the Fathers of medicine except Hippocrates. The estimates of his work vary; he has been regarded as one of the greatest anatomists and physiologists that the world has ever known, and on the other hand he has been blamed for supporting much theoretical doctrine, such as the “pneuma” or spirit, the four humors, and the diatheses, and for his excessive insistence on teleological explanations. There has certainly been a tendency to insist unduly on his mistakes, such as his statement that the blood in the right ventricle of the heart passed through innumerable small invisible foramina in the interventricular septum into the left ventricle, an error of such authority that it persisted until Harvey’s discovery of the circulation in 1628, and even then died hard. He attempted to restore the doctrines of Hippocrates and to make medicine an exact science; as a pioneer of the experimental method he has been called the “Father of Experimental Physiology.” Practically acquainted with the anatomy of the Alexandrian school, which about the middle of the second century A.D. ceased to deal with human subjects, and an admirer of the works of Marinus, he dissected many animals, especially apes, even examining some



embryos, and paid much attention to the muscular system. As the result of applying his knowledge of animal anatomy to that of man, he was responsible for some errors about the anatomy of man. His authoritative insistence on the importance of anatomy eventually led, after the renaissance, to the revival of dissection, without which the discovery of the circulation might have been long delayed; had it not been for this distant result of his influence, medicine would have remained for a much longer time in a depressed state of empiricism and without any scientific basis. Galen must therefore be gratefully remembered as an important forerunner of Harvey. His experimental work covered a wide field, particularly in connection with the nervous system, for example section and hemisection of the spinal cord and the effect of this at different levels of the cord, and section of nerves, especially the recurrent laryngeal; he differentiated the motor from sensory nerves, and showed the neuromuscular mechanism of respiration; he corrected the current belief that the arteries contained air by confirming Aristotle's statement that they carried the blood, and he anticipated the myogenic theory of the heart's action. He was an encyclopedist, writing on philosophy, law, mathematics, and medicine, about 500 treatises in all, of which 181 survive, and in his views on hygiene was a true follower of Hippocrates. His insistence on design and that the structure of the body was determined by God for a useful purpose appealed alike to the Christian and Muhammadan religions, and this perhaps may explain why his works have been

preserved to a much greater extent than those of other ancient writers on medicine. He added very freely to the number of drugs in use, and his polypharmacy was kept in memory up to recent times by the word "galenicals" for vegetable preparations.

After a wandering youth and early manhood, during which he worked at Pergamos, Smyrna, Corinth, and Alexandria, he came to seek fortune at Rome in A.D. 164 when thirty-four years old, and rapidly achieved a leading position. He left it in 166 A.D. when the Antonine plague was approaching; but returned and in 176 A.D. became physician to the Emperor Marcus Aurelius and his son Commodus. With an independent and overbearing personality Galen was continually at war with the medical sects, especially the methodists, and practitioners in Rome; an eclectic and adopting what seemed best from whatever source, he yet elaborated the tenets of pneumatism. During his lifetime he had no school of pupils such as Asclepiades founded, thus contrasting with his almost tyrannous influence over medical thought for a thousand years.

With the death of Galen about 201 A.D. medicine ceased to be progressive, and from a scientific standpoint passed into a period of degeneration, lasting until the renaissance, which began in the twelfth rather than in the fifteenth century. The decline of Rome, which carried medicine with it, has been ascribed to a number of causes: a shortage of currency due to failure of the gold and silver mines of Spain and Greece was followed by heavy taxation, industries and agriculture ceased to be remunerative, land went

out of cultivation, malaria became rampant, and its effect in impairing the physical vitality of the race must be considered as a cause of the decadence of Magna Graecia (W. H. S. Jones). Luxury and moral degeneration played a very important part, and the final fall of Rome was really due to internal rather than external causes, and depended on the Romans rather than on the barbarian invaders. A pessimistic philosophy weighed heavily on the minds of thinking men, and the influence exerted on medicine by Christianity and the neoplatonism of Plotinus (204-270 A.D.) of Alexandria is difficult to estimate accurately. The world of antiquity was sinking into dissolution before the approaching gloom of the Dark Ages.

The position of medicine may now be continued under the headings of Byzantine and Arabian medicine.

## CHAPTER IV

### LINKS BETWEEN GREEK AND MODERN MEDICINE

*Byzantine Period.* With the decline of Rome the center of civilization moved east to Byzantium (Constantinople), which in 321 A.D. under Constantine the Great (288–337 A.D.) became the capital of the Empire instead of Rome. Natural science did not share the activity of Byzantine art, literature, and law; Graeco-Roman medicine remained dormant, and imbibing some elements of orientalism suffered from contamination with folklore, superstition, and magic. The tradition of medicine was preserved by encyclopedic compilations. The period of Byzantine medical literature has been divided into two by the Arabian conquest of Alexandria and the burning of its famous library in 640 A.D.

During the early period the most prominent writers were Oribasius, Aetius, Alexander of Tralles in Lydia, and Paul of Aegina, who wrote compendiums of medicine and surgery, copying from each other and often, as was then a common custom, without punctilious acknowledgment. The compendiums indirectly led to the loss and destruction of original treatises, for the popularity of the compilations resulted in their sources being less carefully preserved. Oribasius (325–403 A.D.) of Pergamos who compiled an encyclopedic digest of medicine, hygiene, therapeutics, and surgery from Hippocratic to his own times, in seventy-five volumes, with conscientious references, also wrote a synopsis of the unwieldy work,



and perhaps this explains why only twenty-five out of the seventy-five volumes have survived. He was physician to the Emperor Julian, the Apostate, and was called "Galen's ape" on account of his faithful imitation. Aetius (*ca.* 500 A.D.) of Amida in Mesopotamia, the first Christian physician of distinction, wrote a compendium on the whole of medicine, "Tetrabiblion" in sixteen volumes with much information on poisons, and reproduced some of the lost works of Oribasius. Alexander (*ca.* 540) of Tralles, near Ephesus, in his twelve volumes on pathology and therapeutics, which show a return to the Hippocratic manner, gives evidence of independent opinion and observation, while reproducing material from Oribasius and others; his writings were much utilized by the School of Salerno. Paul of Aegina, in the seventh century, was, like Aetius, a student of the Alexandrian school; his compendium in seven volumes has the virtue of supplying information about ancient surgery, and from his eminence in midwifery he has been called the "Founder of Obstetrics."

In the second epoch of Byzantine medicine, after the destruction of the library at Alexandria, there is little of value or interest; elaboration of pulse-lore and fanciful ideas about uroscopy were chiefly discussed. With Johannes Actuarius (*ca.* 1300), the last Byzantine author of any note, the period of Byzantine medicine may be considered to have closed.

*Arabian Medicine.* The Arabian period or, as Garrison heads it, the Mohammedan and Jewish periods (732-1096 A.D.) have been described by Osler as the third and by far the strongest branch

of the river which preserved and carried Greek medicine to modern times, the two other branches being the schools of Salerno and Byzantium. In the first instance Greek medicine reached the Arabians from Byzantium by the Nestorians, the followers of Nestorius, the patriarch of Constantinople, who on account of unorthodox views about the Virgin Mary were driven out and took refuge in Mesopotamia about 430 A.D. They translated Greek medical works into Syrian and established two hospitals and a medical school at Edessa, but being expelled again by religious fanaticism in 489, they established a famous medical school at Gondisapor in Persia, which was the nursery of Islamic medicine.

After Muhammad's troops had overrun the eastern world (A.D. 620-650) they turned to science and medicine, thus contrasting with the purely destructive influence exerted on science by the barbarian conquerors of Rome. Advance was slow, for the early part of the Arabian period was occupied in obtaining translations of Hippocrates, Galen, Oribasius, Rufus of Ephesus and Paul of Aegina made chiefly by Syrians, Persians and Hebrews, Sergius of Rasain, and the two Mesuës. More especially should be mentioned Hunain ben Ishaq or Joannitius (809-873 A.D.), an Arab Nestorian, the "Erasmus of the Arabian renaissance," whose translation of Galen's "Microtegni," "Isagoge Joannitii in Medicinam," was used as a textbook in the Middle Ages. Great schools with copious libraries were established at Baghdád in the ninth century and in Spain. Though handicapped by ignorance of anatomy and more important

as transmitters than as makers of knowledge, the Arabians made some original observations, advanced medicine, especially in chemistry and pharmacology, and had fine hospitals. At Baghdád there was a large hospital, of which the physician-in-chief was Razi or Rhazes (850-932 A.D.), so called from his birthplace Ray. A Persian and the most original of the Muslim medical men, he was imbued by the Hippocratic spirit, the author of several works, the most important being "Háwi" or "Continens," and was the first to describe and separate measles and smallpox. Avicenna (980-1036 A.D.), also physician to the Baghdád hospital and the reputed author of a hundred books, the most popular of which was the "Canon of Medicine," was also a poet with a style anticipating that of Omar Khayyam, an astronomer, philosopher, and the "Father of geology." A court physician and known as the "Prince of Physicians," he systematized medicine with mathematic precision. The "Canon" was a concise statement of medicine, in fact notes which his students could learn by heart.

In the Western Caliphate in Spain, which was conquered in 711 A.D., there were medical schools at Cordova, Seville and Toledo, with prominent teachers, such as Albucasis (1013-1106) the Moor, who revived the surgery of Paul of Aegina and has been called the "Arabian restorer of surgery," Avenzoar (1114-1190) who described pericarditis, his pupil Averroës (1126-1198), and Moses Maimonides (1135-1204), an all-round philosopher who wrote on poisons and personal hygiene. Latin translations of Arabic works on medicine, especially Avicenna's, were widely used in



medieval Europe, and, being dogmatic, exerted a powerful influence over European medicine until the fifteenth century.

*The School of Salerno.* The darkness of the Middle Ages was first pierced by light from the star of Salerno, a coast town thirty miles south-east of Naples; this was the commencement of the awakening of medicine in Christian Western Europe from five centuries of coma. The exact date of its origin and the manner in which this famous medical school arose are uncertain. With its delightful climate and the mineral waters in the neighborhood Salerno was a health resort, and hospitals are known to have existed there in the ninth century; the Greek language survived in this part of Italy and it is not improbable that the old Graeco-Roman medicine also persisted. There is not any historical evidence that it was due to the influence of the Benedictine monastery, founded in 528 A.D. at Monte Cassino, eighty miles away, and the admission of women and Jews and the married state of some of the teachers prove that it was not an ecclesiastical foundation. The writings of Gariopontus (1050 A.D.), who in his compilation of prescriptions, "*Passionarius*," drew largely on Alexander of Tralles, of Petrocellus and of others in the eleventh century, do not show any evidence of Arabic influence. Probably the school of Salerno was not the product of external influences, but gradually developed locally into what, from the motto on the seal of its select College of Doctors, has been called the "*Civitas Hippocratica*." The date usually given for the established activity of the medical school is 1000 A.D., though its medical



men had won a wide reputation in the previous century. The *Mulieres Salernitanae* or women teachers, especially Dame Trotula in the middle of the eleventh century, the supposed writer of an extraordinary number of works on diseases of women, Abella, and others are rather misty personages, and doubt has been thrown on their existence except as the reputed authoresses of medical works. Constantine the African (1018-1087), the much travelled monk of Monte Cassino, by his rough translations of Arabic works, of Arabic versions of the "Aphorisms" of Hippocrates in 1080 and of some works of Galen into Latin, introduced Arabic medicine into Salerno. Others followed his example, and by this round-about way Hippocrates and Galen largely came back into European medicine. The school of Salerno was at the height of its reputation when Robert, Duke of Normandy, son of William the Conqueror, came to be cured of a wound in the arm received in the Crusade of 1099, and to him as "King of England," the famous poem on domestic or popular medicine, styled "*Regimen Sanitatis Salernitatum*" or "*Flos Medicinæ Scholæ Salernitanæ*" was dedicated. It has been ascribed to John of Milan, supposed to have been head of the medical school at the time, and has been regarded as a translation into Latin by a baptised Jew, John of Toledo, of a prose epistle written by Aristotle for the benefit of his pupil Alexander the Great. Very probably from the start, and certainly later, it was a collection by several hands. Originally consisting of 362 leonine verses, it gradually grew, as was so common before the advent of printing, to many times

its original length, and, being the most popular medical poem, went through 240 editions up to 1857. It was probably introduced into England about 1250, and was among the early printed books in 1480.

Before the end of the twelfth century the School of Salerno was prominent in raising the standard of surgery, which had sunk to a low ebb in the early Middle Ages. In Roger (Filius Frugardi) of Palermo's "*Practica Chirurgiae*," (1180) end-to-end suture of the divided intestine is described and also the value of mercurial ointments in chronic skin affections. This is an observation of interest as bearing on Sudhoff's view that syphilis had existed in Europe long before Columbus and his crew returned in 1493 from the new to the old world. The recommendation of the treatment of goiter by seaweed, which contains iodine, in a way anticipated Coindet's use in 1820 of iodine, which was discovered in 1811 by Courtois, a soap-boiler in Paris, with the assistance of a chemist Clément. Roger's pupil Roland of Parma, who edited his master's textbook about 1230, was another surgeon of eminence at Salerno. Pierre Gilles de Corbeil (Petrus Aegidius Carboliensis), the poet-physician, was educated at Salerno, and about 1200 carried its medicine to Paris where he was archiater to Philip August, King of France (1180-1223). He wrote poems on the pulse and uroscopy, subjects which had both been elaborated at Salerno.

The school of Salerno, which had kept alight the lamp of pure Greek medicine in Europe for two centuries, did not receive any official recognition until 1231, when Emperor Frederick II,

who in 1224 had founded a *studium generale*, an institution which later became synonymous with a university, at Naples, ordained that all medical teachers and practitioners should obtain a license from the King's court, only to be awarded after examination by the Masters of Salerno. Salerno was during most of its existence a studium of medicine only. But the competition of medical faculties in the universities of Montpellier and Bologna, and the increasing popularity of Arabian medicine, which had become blended with Greek medicine, led to the decline of the Salerno school by the beginning of the fourteenth century. The University, the medical importance of which had disappeared four centuries before, was suppressed by Napoleon in 1811.

*The Medieval Period and the Rise of Universities.* This, which may be regarded as the scholastic or monastic period, covering the interval between about the beginning of the twelfth and the middle of the fifteenth century, was characterized by the paralyzing effect of Arabian medicine with its respect for dogma and authority, which, however, must be gratefully remembered for the preservation of ancient medical literature and traditions. The university teaching of medicine was verbal and consisted largely, at first entirely, in the study of texts and Arabian compendiums.

The rise of the universities began in Italy, and constitutes the great intellectual achievement of the Middle Ages. The universities came into being by a gradual evolution, and not by a formal founding, such as is familiar in modern times. There were two kinds of universities: in the "student-universities," like that of Bologna,



guilds or clubs of students, afterwards called "nations," came into existence spontaneously and without the imprimatur of royal or papal authority; these students' guilds largely chose and controlled the teachers and arranged the lectures. A relic of this perhaps remains in the rectorial elections in the Scottish universities. In the other type the masters or teachers had the upper hand; thus the University of Paris and those of Oxford and Cambridge, which were on much the same lines as that of Paris, were "master-universities" and specially ecclesiastical.

*Bologna*, famous as a school of the liberal arts and dialectic as early as 1000 A.D., became specially prominent for its legal instruction; students' guilds were formed, and eventually about the middle of the thirteenth century, more than a century later than the date often given, a student-university came into being. There was an organized school of medicine as early as 1156, but the teaching was confined to the reading of texts. Although here the status of medicine always remained inferior to that of law, Bologna occupies an important position in medieval medicine, and only less so than Salerno and Montpellier. Surgery made advances under the leadership of William of Saliceto, who was a professor in 1268, and Thaddeus (1223-1303) of Florence, both of whom apparently had seen necropsies. Lanfranc, a pupil of William of Saliceto, afterwards became the virtual founder of French surgery. But the important event was the organized dissection of human bodies, which Singer traces to the performance of postmortem examinations for medico-legal purposes. Mundinus (1270-1326), a pupil of Thaddeus, was professor of anatomy (1306-26) and both dissected and wrote a text-book "*Anothomia*" (1316); this was the first book solely dealing with anatomy, for previously anatomy had been included in treatises on surgery; as a manual for dissection it was popular for two hundred years.

*Padua*, a student-university, was an offshoot in 1222 from Bologna as a result of quarrels between that city and the students; it was protected by Venice, of which it



became the University or, in Renan's words, its "quartier latin." It became much more important medically than Bologna; it had the first anatomical theater and botanical garden in the world, and its anatomical and clinical teaching by Vesalius, Falloppius, Fabricius, and Montanus (1498-1552) attracted students such as Thomas Linacre, John Caius, Harvey, and William Petty.

*Pisa* became a university in 1343, and towards the end of the fifteenth century, after the University of Florence was merged into it in 1472, became a leading Italian university, second only to Padua. In 1657, when Borelli, Malpighi and Redi were actively at work, it was more prominent even than Padua. At the University of *Pavia*, founded in 1361, medicine was actively taught in 1433, though anatomy was not among the subjects of instruction until 1467.

At *Montpellier* there was a medical school in 1137 which, as that of Salerno declined, rose into prominence, the formal establishment of its University taking place in 1220. In the thirteenth and fourteenth centuries among its notable teachers were Arnold of Villanova (1235-1311), and Bernard of Gordon from 1285 to 1307, whose "*Lilium Medicinæ*" (1306), a textbook on Arabian lines, contains the first reference to spectacles; the "*Compendium Medicinæ*" (1510) of Gilbert the Englishman was on much the same lines, but is the first to refer to the contagious nature of smallpox. Henri de Mondeville (1260-1320) and Guy de Chauliac (1300-68), who were contemporaries of the English John of Gaddesden (1280-1361), the author of the "*Rosa Anglica*" (1314) in which the red light treatment of smallpox, known to Bernard of Gordon and Gilbert, is mentioned, and John of Arderne (1306-90) were also notable teachers of this school. The influence of Hippocrates and Galen, especially of the former, was on the whole, more powerful than that of Arabian medicine throughout the existence of the school. Up to the time of Avicenna surgery and medicine were one, surgery being merely an alternative form of treatment; but about the beginning of the sixteenth century the medical faculties of Montpellier and Paris finally separated surgery from medicine, much to the latter's detriment.

In *Paris*, where students had long congregated, a "master-university" arose in the last quarter of the twelfth century; but the medical school did not rival that

of Salerno or Montpellier and, if it is true that during the fifteenth century no candidate failed to satisfy the examiners, the standard was low. Paris remained obstinately Galenic and, just as Jacobus Sylvius (1478-1555) opposed Vesalius' new anatomy, so did Jean Riolan the younger (1580-1657) attempt in 1648 to controvert Harvey's discovery of the circulation, and in 1671 the theological faculty led the others in forbidding any deviation from Aristotle's principles of physics. At the end of the sixteenth century there were thirty thousand students in Paris, but the University curriculum was practically unaffected by the new scientific spirit. In 1644 instruction at a polyclinic was begun.

At the Universities of *Oxford* and *Cambridge*, established in the second half of the twelfth century as "master-universities" and probably modelled on that of Paris, regius professorships of medicine (1546) and of physic (1540) were founded by Henry VIII; but these universities never had complete schools of medicine, the clinical work being done in London or other large cities.

In Eastern Europe, the Universities of *Prague* in 1348 and of *Vienna* in 1365 were founded on the model of the Paris school, and in 1364 that of *Cracow* in Poland. By the end of the seventeenth century the number of universities in Germany had increased to thirty-nine, and in this same century a number sprang up in Holland.

During the fourteenth and fifteenth centuries "consilia" or written commentaries on medical cases came into vogue, especially in Italy. Prominent teachers on these lines were Bartholomaeus Montagnana (ca. 1460) of Padua, Ferrari da Grado (ca. 1460) of Pavia, and Antonio Benivieni (ca. 1500) of Florence, who in his posthumous "De Abditis nonnullis ac mirandis Morborum et Sanationum Causis" (1507) supplemented these records by postmortem accounts, and thus anticipated Morgagni.

## CHAPTER V

### THE RENAISSANCE AND THE SEVENTEENTH CENTURY

*The Renaissance of Medicine.* The general revival of learning in Europe began about the twelfth rather than as was formerly considered, in the fifteenth century with the humanistic movement to recover lost culture, of which the poet Petrarch (1304-74) was a leader. Subsequently important factors were the dispersal of Greek scholars and manuscripts after the capture of Constantinople (1453) by the Turks, and the invention of printing in the middle of the fifteenth century. Medicine of course shared in this renaissance.

The revival of anatomy was bound up with the revolt against Galenic tradition in a rather curious manner; for, though on the one hand the wider acquaintance with Galen's writings led to the active practice of dissection, on the other hand it coincided with a protest against his dominating authority and was followed by a correction of his mistakes. Vesalius indeed first, in 1538, brought out a revised edition of Guinterius' "Anatomical Institutions According to Galen" without making any revolutionary changes, and later, in 1543, proceeded to show Galen's errors in human anatomy. The movement against Galenic domination gradually arose from the influence of Jean Fernel (1497-1558); of Fracastorius (1483-1553) of Venice, a poet, geologist, the author of "Syphilis sive Morbus Gallicus" (1530) and "De Contagione" (1546) in which,



by imagining that invisible seeds (*seminaria contagionum*) spread disease, he prophesied the bacteriology of the nineteenth century; of Jerome Cardan (1501-76) who invented a system like Braille's (1829) for the blind, and most forcibly of Paracelsus (1493-1541) who dramatically burned Galen's and Avicenna's works in the marketplace at Bâle. Until his relative Karl Sudhoff threw a more favorable light upon him, Aureolus Theophrastus Bombastus von Hohenheim or Paracelsus was usually regarded as a drunken quack or as a cross between a mystic and a mountebank. He was the most original and independent medical thinker of the sixteenth century, had a great influence as an iconoclast, being in Osler's words the "Luther of medicine," and in a number of directions, especially in chemistry, was much ahead of his time.

Mundinus' activity in dissection (1306-26) was for nearly two centuries an isolated effort; his textbook was often reprinted or commented on, for example by Berengarius of Carpi (1521) and Dryander (1541). In the fifteenth century Leonardo da Vinci (1452-1519), the universal genius and "forerunner" of so many subsequent discoveries, dissected thirty old men and women, and Albrecht Dürer (1471-1528), Michael Angelo (1475-1564), and Raphael (1483-1521) thus improved their skill in the representation of the human form. Leonardo's recently published notebooks show that he was a marvelous biologist, but this influence was not exerted during his lifetime. The medical humanists (1450-1550) counteracted the slavish respect for authority inherent in Arabian medicine, and substituted



direct translations of Hippocrates and Galen for translations from Arabian reproductions of and commentaries on these authors. Broadminded and scholar-physicians active in the study of "the humanities," as Greek and Latin were called, the medical humanists, by encouraging a knowledge of Greek, made Galen's texts more widely available, and thus played a part in bringing about the revival of anatomy. Here should be mentioned Thomas Linacre (1460?-1524) who brought Greek to England, translated Galen's "Methodus Medendi," of which Erasmus (1466-1536) wrote, "I present you with the works of Galen, now, by the help of Linacre, speaking better Latin than they ever before spoke Greek," and founded the Royal College of Physicians of London in 1518; John Caius (1510-73), a keen Grecian and Galenist, who learned anatomy at Padua in 1539 and then lectured for twenty years in London, was President of the College of Physicians for nine years and Master of Gonville Hall, Cambridge; and Conrad Gesner (1516-65) the "Father of Bibliography."

Jacobus Sylvius (Jacques Dubois, 1478-1555), the first great practical anatomist at Paris, where he began to teach in 1531, has been described by Singer as "a humanist getting into touch with practical anatomy." Among his and Joannes Guinterius's (1487-1574) pupils in 1533 was the great Andreas Vesalius (1514-64), the "Father of Modern Anatomy." By his epoch-making work on anatomy, transmitted by his successors at Padua, Falloppius (1523-62) and Fabricius ab Aquapendente (1537-1619), he not only prepared the way for the renaissance of physiology by

Harvey, who was Fabricius' pupil at Padua, but undermined the widespread reverence for authority in science, thus leading to independent observation in clinical medicine as well as in anatomy.

*The revival of physiology* dates from the rebirth of the experimental method and William Harvey's (1578-1667) immortal demonstration of the circulation. The practical bearings of Harvey's work on the understanding and treatment of cardiovascular disease were not realized for very many years; but even greater, because more far-reaching, results of his discovery were the new birth of the experimental method and the substitution of enquiry for the trammels of authority and tradition. In this way Harvey may justly be regarded as the founder of the modern science of medicine. Harvey never saw the final proof provided by the capillaries, which were described in 1661 by Marcello Malpighi (1628-94) using the microscope probably invented in 1590 by the Janssens of Middelburg in Holland; this was confirmed in 1674 by Antonj van Leeuwenhoek (1632-1723) of Delft, the "Father of Microscopy," who, like Jan Swammerdam (1637-80) in 1658, recognized as such the red blood corpuscles in the capillaries.

As a logical, if not direct, result of the discovery of the circulation of the blood, Christopher Wren (1632-1723) in 1656 injected wine and ale into the veins of a dog in the direction of the heart, and anticipated that this practice of administering drugs would be useful in medicine, a hope not realized until the twentieth century. Richard Lower (1631-91) transfused dogs with blood in 1665, and two years later Jean Denys, professor

of mathematics at Montpellier, injected the blood of animals into men. Lower's "Tractatus de Corde" (1669) recorded numerous experiments, such as the production of ascites by venous obstruction, on the nerve supply of the heart, and on the change of color of venous blood to that of arterial blood when exposed to the air.

*Chemistry and Physics in Relation to Medicine in the Seventeenth Century.* The developments in these two sciences naturally influenced physiology and medicine, and gave rise to two "systems" of medicine, the iatrochemical and the iatrophysical or iatromathematical, both of which explained life on materialistic or mechanistic lines. An antagonistic position was taken by the "vitalism" of G. E. Stahl (1660-1734), the German chemist responsible for the misleading idea of phlogiston, who believed that the life and growth of the body were controlled, not by the laws of chemistry and physics, but by the *sensitive soul*, the hypothesis of "animism"; his idea that disorder of the mind caused bodily disease has been regarded as the germ of Freud's doctrine and has an obvious relation to Christian Science.

Chemistry emerging from alchemy was stimulated in some respects by the declamations, wild and extravagant though some of them may be, of Paracelsus (1490-1541) and his follower J. B. van Helmont (1577-1644). Later Franciscus Sylvius (1614-72) established at Leyden the first chemical laboratory in Europe, and may be regarded as the founder of the *iatrochemical school*; he trusted much to the effect of acids and alkalies in explaining the phenomena of health and disease, thus recalling the acidosis and alkalosis of recent



years, but relied on a chemistry then in its infancy. Later Thomas Willis (1621-75) who, as Paracelsus had previously done, detected sugar in diabetic urine, Robert Hooke (1635-1703), John Mayow (1643-79) who nearly discovered oxygen, Robert Boyle (1627-91) the seventh son of the Earl of Cork and "Father of Modern Chemistry," and others established chemistry as a science and the handmaid of physiology.

The *iatrophysical school*, a result of Harvey's discovery, was stimulated by the mechanical philosophy of René Descartes (1596-1650) whose posthumous "De homine Liber" (1662), the first popular textbook on physiology, described the human body as a machine under the control of a soul in the pineal body, and did much to popularize experimental investigation. The real founder of the school was Giovanni Alfonso Borelli (1608-79) a physicist and mathematical professor in several Italian universities, including Pisa where he worked with Malpighi. This school was on surer ground, as William Gilbert's (1540-1603) great work "De Magnete, Magnetisque Corporibus, et de magno Magneto tellure, Physiologia nova" (1600) was based entirely on experiment, and as the firm foundations of mechanics had been laid by Galileo (1564-1642). Borelli, a follower of Galileo, explained the phenomena of the living body as problems of physical science, and was successful in adding a great deal to the knowledge of muscular action and contraction, a subject further elucidated by Niels Stenson or Steno (1638-86) of Copenhagen in 1662 and exaggerated by Archibald Pitcairne (1652-1713) of Edinburgh. As Sanctorius' experi-



ments show, the iatrophysical school influenced medical practice, among other ways in leading to the taking of the pulse rate and the bodily temperature.

The seventeenth century was marked by the establishment of the societies or academies for experimental research; in this Italy led the way; in 1601 there was founded the *Accademia dei Lincei*, with its device of a lynx tearing a Cerberus with its claws, to symbolize the struggle of scientific thought with ignorance; its publications (1609) were by far the earliest of any scientific society. It was followed by the famous *Accademia del Cimento* at Florence which included Borelli, Francesco Redi (1626-97), and Niels Stenson, and devoted ten years (1657-67) to the elaboration of experimental science and the production of a treatise which inspired other learned societies during a century. In Germany the short-lived *Societas Ereunetica* was founded at Rostock in 1622, and in 1652 the *Collegium Naturae Curiosorum* at Schweinfurt; the latter was composed of medical men only, with the object of publishing the researches of its members, and so resembled a number of medical societies in Great Britain a hundred years later. The Royal Society of London (1662) grew out of the "Invisible College" (1645) in London and the "Experimental Philosophicall Clubbe" (1649) at Oxford, and medical problems took a much more prominent place in their proceedings than in these days of greater specialized research; their transactions indeed were for a time the chief means, apart from books and pamphlets, by which medical observations were made public; for the first English medical

journal was the very short-lived *Medicina Curiosa* in 1684. In Paris the Académie des Sciences was founded in 1666, a year after the appearance of the *Journal des Sçavans*, which in 1667 contained papers on blood transfusion. The first medical journal in Paris was the *Nouvelles découvertes sur toutes les parties de la médecine* (1679-81). In North America the first medical journal was *The Medical Repository* of New York which started in July 1797 and came out quarterly; the next to appear on the scene was the *Philadelphia Medical and Physical Journal* in 1804. The London *Lancet*, a weekly journal, was started in 1823 by Thomas Wakley (1795-1862) and by vigorous criticism did much in bringing about medical reforms.

The scientific societies of the seventeenth century were more active and successful in fostering experimental research than were the universities taken as a whole, though the pioneer influence of the Italian universities in the application of the experimental method to medicine was an outstanding exception. Most of the universities were conservative, much controlled by religious fanaticism, and were without the cooperation of many of the most eminent men of science. The example set by the scientific societies of the seventeenth century eventually so influenced the universities as to make them active promoters instead of opponents of experimental science.

*Clinical Medicine in the Seventeenth Century.* In addition to the influence exerted by the revival of learning and the revolt against traditional authority, a further stimulus to independent investigation had been provided by the occurrence

of new problems, such as the widespread outbreak of syphilis and the appearance of the sweating sickness at the end of the fifteenth century, on which the works of Hippocrates and Galen could not give any guidance. The outstanding figure in clinical medicine in the seventeenth century was Thomas Sydenham (1624-89), "the English Hippocrates," a sturdy independent spirit who paid no attention to the authorities of the past, except Hippocrates, and took no interest in contemporary scientific progress or its leaders, except Francis Bacon (1561-1626) and Robert Boyle. His education at Oxford was interrupted by fighting for the Puritans in the Civil War, and his only other academic instruction was for a short time, about 1659, at Montpellier where, unlike other French schools, the teaching of Hippocrates was ranked above that of Galen. He studied diseases as objects of natural history, insisted on observation, emphasized the constant and essential while keeping the accidental and unimportant symptoms in due proportion, and set a much needed example in avoiding speculative theory and blind obedience to traditional authority. As a result his concise descriptions of chorea, hysteria, acute diseases, gout, and the distinction between scarlet fever and measles are classical. Diseases, he believed, had each their specific remedies which should be sought for, though the only example he knew was the cure of malaria by Jesuit's bark or cinchona (quinine) which in 1640 had been brought by the Jesuits from Peru, where the Countess of Chinchon had been cured by it in 1638. But he firmly believed that diseases were Nature's



attempt to throw off the morbid matter, and in Nature's inherent power of healing, which should therefore be imitated. Diseases, he urged, should be arranged in species as in the classifications of plants and animals, and he has thus been regarded as the founder of scientific nosology. An attempt to classify disease had been made in 1602 by Felix Platter (1536-1614) of Bâle, and many elaborate nosologies in the eighteenth and early years of the nineteenth century were constructed by François Boissier de la Croix de Sauvages in 1731 and later in 1763, Linnaeus in 1735 and again in 1763, Vögel of Göttingen in 1764, W. Cullen in 1769, Selle in 1770, D. MacBride of Dublin (1772), Sagar of Vienna (1776), Vitel of Lyons (1778), Bang of Copenhagen (1789), Pinel (1798), Alexander Crichton (1805), Bartholomew Parr (1809), Thomas Young (1813), and John Mason Good (1817). After this interest in the subject died down. In 1869 the Royal College of Physicians of London brought out an official Nomenclature of Diseases which has been revised every ten years. Since 1900 an International Commission has brought out every ten years a list of causes of death for international use, particularly for the comparison of statistical returns.

Although vigorously opposed to preconceived hypotheses, especially perhaps of a chemical character, Sydenham was not entirely free from speculation; in his attempts to obtain a cure for epidemic fevers he carefully analysed their incidence and variations, and thus arrived at his famous "epidemic constitutions," a somewhat mysterious conception of a more elaborate character than those of Hippocrates and of Ballonius



(Guillaume Baillou) in 1574. From observation of acute epidemic disease in London from 1661 to 1675 he recognized five periods, each characterized by a special constitution or influence derived not only from the atmosphere and the weather, as Hippocrates believed, but from the bowels of the earth. Thus in one period the epidemic constitution was malarial, in others like the plague, smallpox, dysentery, or coma. He has therefore been called "the founder of the modern science of epidemiology"; recently W. H. Hamer, F. G. Crookshank, and Major Greenwood in England have revived the conception of "epidemic constitutions."

Walter Harris (1647-1732), a follower of Sydenham, published "*De Morbis acutis Infantum*" (1689) in which he showed some glimmerings of the modern acidosis and sternly forbade the use of opium, thus contrasting with Sylvius of Leyden who in his treatise "*De Morbis Infantum*" (1680) advised it so often that he was called "Doctor Opiatus." Francis Glisson (1597-1677) was a philosopher, physiologist, physician, an authority on orthopedics and on morbid anatomy; he described muscular irritability and anticipated by almost a century the modern teaching of muscular physiology in his "*Tractatus de Natura Substantiae energeticae*" (1672); later Haller in 1757 and W. Cullen (1712-90) developed the doctrine of irritability and John Brown (1735-88) of Edinburgh carried it to excess in his sthenic and asthenic diseases. Glisson gave the first description of rickets in 1650, which contained an account of scurvy in children and was so complete that comparatively little was added

until the advent of vitamins and the influence of light in this century; his "Anatomia Hepatis" (1654) made his name and capsule forever familiar. Christopher Bennet (1617-55) and Richard Morton (1637-98) wrote on pulmonary tuberculosis and its morbid anatomy; Wepfer of Schaffhausen showed that apoplexy was a result of hemorrhage into the brain (1658), and Thomas Willis (1621-75) was a pioneer in the anatomy and diseases of the nervous system. John Graunt (1620-74), William Petty (1623-87) and Edmund Halley (1656-1742), the English Astronomer Royal, laid the foundations of vital statistics. Pharmacopeias were developed from the herbals, or lists of plants used for medical purposes, which date back to the fourth century B.C.; in Germany a herbal, the "Hortus Sanitatis," was printed in 1491, in Great Britain the first to be printed was Banckes' in 1525, and was followed by those of William Turner (1551) and John Gerard (1597). The first pharmacopeia appeared at Lyons in 1561; the Royal College of Physicians of London in 1618 brought out the "Pharmacopoeia Londinensis" which, like the Augsburg pharmacopeia in 1648, was on a more elaborate scale. The separate pharmacopeias of London, Edinburgh and Dublin were in 1864 collated in the British Pharmacopoeia.

## CHAPTER VI

### THE SCHOOL OF LEYDEN AND CLINICAL MEDICINE IN THE EIGHTEENTH CENTURY

The University of Leyden, dating from 1571, was made famous by the leading physician of his day, Hermann Boerhaave (1668-1738) whose world-wide reputation brought him letters addressed "Dr. Boerhaave, Europe," and a medical deputation from China. The inspiring influence of Greek medicine was carried to Leyden by Jan van Heurne (1543-1601) who, after working four years under Fabricius at Padua, became in 1581 professor of anatomy at Leyden, where he introduced not only Vesalian anatomy but practical clinical teaching. This was carried on by Franciscus Sylvius and greatly developed by Boerhaave, the "Dutch Hippocrates," who also excelled as a teacher of chemistry and botany, was a voluminous and influential writer, edited a number of medical classics as his wide knowledge of languages enabled him to do, but did very little experimental work. The Fahrenheit thermometer was used in his clinic. His pupils carried his teaching far and wide; Edinburgh, and so eventually North America, thus came under the influence of Greek medicine through, among others, Alexander Monro *primus* (1697-1767) and John Rutherford (1695-1779), the first professor to give clinical lectures in the Royal Infirmary there. Vienna profited from the training received by van Swieten (1700-72) and de Haen (1704-76); and the encyclopedic Albrecht von



Haller (1708-77), the author of 1300 scientific papers, who next to his master is the most outstanding medical personality in the eighteenth century, carried the traditions of Leyden to Göttingen and Bern. Broadmindedly Boerhaave did not follow any of the theories of the time, and has been regarded as the founder of the "eclectic school." He was a most kindly man and was compared by Allbutt to Asclepiades in the century before Christ, and in many respects, including his attractive personality, might be classed with Conrad Gesner (1516-65) and William Osler (1849-1919).

Among others who advanced clinical medicine William Heberden the elder (1710-1801), the "British Celsus," was in 1768 the first to describe on an adequate basis *angina pectoris*, and in his famous "Commentaries," published posthumously (1802), referred to a hundred cases. The coronary origin was put forward by Edward Jenner and C. H. Parry in 1788 and by Allan Burns in 1809; in 1837 Dominic Corrigan and from 1894 onwards Clifford Allbutt ascribed the condition to disease of the first part of the aorta; and later James Mackenzie considered that cardiac failure of contractibility was the responsible factor. The syndrome of coronary thrombosis was not really recognized until the present century (Obrastzow and Strachesko, 1910; J. B. Herrick, 1912). William Withering (1741-99) introduced the use of digitalis (1785), though as a remedy for dropsy rather than for cardiac failure. In 1748 John Fothergill (1712-80) described malignant sore throat or diphtheria, as Bretonneau called it in 1826, before Huxham's



account in 1757. William Cullen (1712-90), a professor both in Glasgow and Edinburgh, belonged to the iatrophysical school; his conception of disease as due to spasm or atony exerted a wide influence but, as already mentioned, was carried to excess in the Brunonian theory of his pupil John Brown (1735-88); he did good service in directing attention to the patient rather than to the disease. In North America the War of Independence directed attention to the necessity for medical reform, and among others brought to the front John Morgan (1735-89) of Philadelphia, the "Father of medical education in America," and Benjamin Rush (1745-1813), the "American Sydenham." The treatment of the insane, which previously had been a "mixture of pharmacy, superstition and castigation," was first made humane in the hands of William Tuke (1732-1822) of The Retreat, York, in 1794, and of Philippe Pinel (1745-1826) of Paris in 1798, and later by John Conolly (1794-1866) at Hanwell in 1839.

The original investigations and philosophical principles of John Hunter (1728-93) "the founder of scientific surgery," ranged so widely over biology in its broadest sense that they provide the basis for medical science as a whole, and are in no way confined to the branch of the profession which he did so much to elevate to its proper position. Osler described him as combining the qualities of Vesalius, Harvey, and Morgagni. He was the first pathologist of his day, by the collection of 13,600 specimens set an example for all time of the importance of medical museums, and in his "Treatise on the Natural History of

the Human Teeth" (part i, 1771, part ii, 1778) placed dentistry on a scientific basis.

*The Rise of Preventive Medicine.* The ideal of medicine, namely the prevention of disease, owes much to the recommendations of John Pringle (1707-82) of the British Army and of James Lind (1716-94) of the Royal Navy. In his "Observations on the Diseases of the Army" (1752) Pringle laid down the rules of military sanitation, such as cleanliness, proper drainage, latrines for camps, and the ventilation of hospital wards. He showed that typhus fever was the same as "hospital fever," and in his published "Experiments upon Septic and Antiseptic Substances, with Remarks relating to their Use in the Theory of Medicine" (1750) was a pioneer of the antiseptic idea. His suggestion that army hospitals should be regarded as immune from attack originated the Red Cross and was put upon an absolute basis by the Geneva Convention in 1864. Benjamin Rush of Pennsylvania wrote on the hygiene of troops in 1777.

James Lind, the "Father of Nautical Medicine and Hygiene," was physician to the Royal Naval Hospital, Haslar, from 1758 to 1783, and as the result of his service afloat from 1739 to 1748 wrote his "Treatise on the Scurvy" (1754) which advocated its prevention and treatment by fresh vegetables and fruit, especially oranges and lemons, and when they were not available by preserved orange and lemon juice. Unfortunately this treatment was not officially enforced in the Navy for forty-one years; but when this was effected in 1795 by the driving power of Sir Gilbert Blane (1749-1834) scurvy disappeared.

In his "Essay on the Most Effectual Means of Preserving the Health of Seamen in the Royal Navy" (1757) he established the principles of naval hygiene. His "Essay on Diseases incidental to Europeans in Hot Climates" (1768) dealt not only with the prevention and cure but also with climate and its influence on disease; he was therefore a great pioneer of tropical medicine. But a century and a half earlier Richard Hakluyt (1552-1616) was anxious to found a school for tropical medicine, perhaps inspired by the first book on the subject in English, and probably in any language, "The Cures of the Diseased in Forraine Attempts of the English Nation" (1598) by George Wateson, which was reproduced in facsimile by Charles Singer in 1915. The Reverend Stephen Hales (1677-1761), the experimental physiologist, and John Howard (1726-90) devoted much time to improving the sanitary conditions in prisons, and Thomas Percival (1740-1804), the author of a standard work on "Medical Ethics" (1803) was a pioneer in reforming the condition of factory workers, especially children and dwellers in the slums of Manchester. The foundations of modern public hygiene were laid by Johann Peter Frank (1745-1821) the Bavarian in his "Complete System of Medical Polity" (1777-88). John Haygarth (1749-1827) of Chester instituted the isolation of patients with typhus and other fevers in 1783, and advocated a system of notification. Richard Mead (1673-1754), a follower of the iatromechanical school, published in response to a request by the Government a "Short Discourse concerning Pestilential Contagion, and the Methods to



Prevent It" in 1720, advocating quarantine against the plague then raging at Marseilles in France; Parliament made quarantine compulsory and the plague did not reach England. During the second half of the eighteenth century a large number of hospitals were established in London and the country, and sanitary conditions in a number of the large cities underwent a change for the better with the passage of local Improvement Acts.

An epoch-making event in preventive medicine was the appearance in 1798 of Edward Jenner's (1749-1823) "Inquiry into the Causes and Effects of the Variolae Vaccinae" which conclusively proved that vaccination with cowpox material provides protection against smallpox. It was introduced into America in 1800 by Benjamin Waterhouse (1754-1846). This was the first step in the artificial production of immunity which was later developed by Louis Pasteur. Jennerian vaccination was rapidly adopted and extinguished the previous method of obtaining protection by inducing an attack of the disease by inoculation of material from human patients with smallpox, or variolation. This had long been practised in the Orient and was introduced into England and soon after advocated by Hans Sloane (1660-1753) in 1717 and by Mead in 1722 and 1747. There were many inoculators, among them Zabdiel Boylston (1679-1766) of Boston, Massachusetts, who began in 1721, and Thomas Dimsdale (1712-1800) who in 1768 successfully inoculated Catherine, Empress of Russia, and her son the Grand Duke Paul.



## CHAPTER VII

### THE NINETEENTH CENTURY

In the first half of the nineteenth century epidemics of cholera in England in 1831, 1849, and 1854 gave rise to such a demand for reform that the State appointed Royal Commissions in 1843 and 1869, the General Board of Health in 1848 and the Local Government Board in 1871. The prominent movers in the cause of public health were Southwood Smith (1788-1861), Edwin Chadwick (1800-90), and John Simon (1816-1904). John Snow (1818-58) showed in 1854 that cholera was spread by polluted water and thus established the importance of water-borne diseases. In 1919 the present Ministry of Health took over the duties performed by the Local Government Board. The recent establishment of ante-natal, child-welfare, school, dental, tuberculosis, and venereal disease clinics has done much to improve the national health. Public health is not exactly synonymous with preventive medicine, but is part of that conception and specially applies to the mass of the community. Preventive ideas should permeate medicine as a whole and be as important as, or rather more so than, the treatment of the sick. In the promotion of the prevention of disease education of the public in the laws of health forms, as George Newman (1870- ) has insisted, an essential part.

Max von Pettenkofer (1818-1901) of Munich, the founder of experimental hygiene, put forward very definite views on the relation between epidemics and the water in the soil and was the

first to institute a laboratory for hygienic investigation. By the application of expert statistical knowledge to epidemiology J. Brownlee (1868-1927) showed that the occurrence and duration of epidemics could be accurately foretold.

In America the care of the public health was first entrusted to the Marine Hospital Service. Lemuel Shattuck (1793-1859) in 1850 acted in the same stimulating capacity as Chadwick did in England; J. S. Billings (1838-1913) was a later power in preventive medicine, and Hermann M. Biggs (1859-1923) was a most internationally minded administrator. Periodic examination of adults, so as to detect incipient disease, has recently been employed in America and undoubtedly promises to be a valuable means of preventing disease, for it is on the same lines as the periodic overhaul of the teeth which makes modern dentistry such an outstanding example of preventive medicine.

*Industrial Medicine.* The earliest writer on industrial medicine was the Italian Bernardo Ramazzini (1630-1714) in "De Morbis Artificum Diatriba" (1700), a subject broached a century earlier by Paracelsus. Lead poisoning was shown in 1757 to be the cause of Poitou colic by Théodore Tronchin (1709-81), and in 1767 George Baker (1722-1809) proved the same cause to be responsible for the Devonshire colic among cider drinkers, described in 1739 by James Huxham (1692-1768). C. Turner Thackrah (1795-1833) of Leeds wrote a book on trade diseases in 1831. Later in the nineteenth century the knowledge of industrial diseases was much advanced by the activities of E. H. Greenhow (1814-88)

on pneumoconiosis, T. Oliver (1853– ) on dangerous trades, and especially lead, the Medical Inspectors of Factories of the Home Office, T. M. Legge, E. L. Collis, and others in England. The Industrial Fatigue Research Board and C. S. Myers (1873– ), Director of the National Institute of Industrial Psychology, have thrown much fresh light on the incidence of accidents and disease among industrial workers. In America Alice Hamilton, working especially on plumbism and benzol poisoning, and the experimental work of C. K. Drinker and the Harvard School of Public Health, Boston, have been prominent in the creation of a special branch of medicine.

*The Physical Signs of Disease.* Physical diagnosis followed and largely depended on a knowledge of morbid anatomy, for which the work of Benivieni, Morgagni and others in previous centuries had afforded a sound beginning. The publication of Leopold Auenbrugger's (1722–1809) "Novum Inventum ex Percussione Thoracis humani" (1761) was, however, years in advance of the times, so that percussion did not receive any attention until the "Novum Inventum" was translated into French in 1808 by J. N. Corvisart (1755–1821) of Paris, where by this time morbid anatomy, thanks to Marie François Xavier Bichat (1771–1802) and Corvisart, was actively advancing. The discovery of mediate auscultation and the introduction of the stethoscope by René Théophile Hyacinthe Laënnec (1781–1826), an accomplished morbid anatomist, in 1816, his great work "Traité de l'auscultation médiate" appearing in 1819, form a great milestone in medical history; for thus morbid lesions were eventually corre-



lated accurately with physical signs. It is true that immediate auscultation, namely the direct application of the ear to the chest, had been employed by Hippocrates and later, though rather exceptionally and spasmodically, by others: Harvey, R. Boyle, R. Hooke (1635-1703), G. L. Bayle (1774-1816), and Corvisart, but without yielding any material addition to knowledge. Though the stethoscope is obviously more convenient than the naked ear, the enormous advances that followed its invention were really due to the psychological effect that the new method exerted on Laënnec and his followers, who without this hope-inspiring stimulus would not have so persistently practised auscultation as a means of diagnosis. Much the same holds good with regard to the pleximeter introduced in 1828 by P. A. Piorry (1794-1879) for mediate percussion which, though inferior to Auenbrugger's direct percussion as a means of eliciting physical signs, encouraged investigation by the method. Percussion and auscultation made their way somewhat slowly, and, as in the case of Harvey's discovery, they appealed to men with young minds only, such as William Stokes (1804-78) author of an "Introduction to the Stethoscope" (1825), C. J. B. Williams (1805-89) as shown by his "Rational Exposition of the Physical Signs of Diseases of the Lungs and Pleura" (1828), John Elliotson (1791-1868) by his "Recent Improvements in the Art of distinguishing the various Diseases of the Heart" (1829), James Hope (1801-41), morbid anatomist as well as clinician, whose "Diseases of the Heart and Great Vessels" (1831) contained much new material

based on clinical and experimental observation, and J. B. Bouillaud (1796-1881) who in 1836 established by postmortem and clinical observation the importance of acute rheumatism in causing endocarditis. Elaboration of physical diagnosis went ahead in the middle of the nineteenth century, and indeed somewhat exaggerated importance became attached to the presence of a cardiac murmur. Intensive study of the end-results of disease led to a phase of scepticism as to the power of treatment; but subsequently this therapeutic nihilism was mitigated when disorders of function were investigated, and immunology and the specific nature and treatment of disease came on the scene. In the present century morbid anatomy and its physical signs have been overshadowed by renewed attention to symptoms and the evidence of impaired physiological efficiency; and especially in cardiac disease, prognosis, which previously had not bulked so prominently as diagnosis, received much more consideration. Palpation, percussion, and auscultation ceased to be practically the sole means of obtaining physical signs of disease when, some years after the discovery of x-rays by W. K. von Roentgen (1845-1922) in November 1895, radiological examination became available, and the polygraph and electrocardiograph were applied to the detection of cardiac and other diseases.

*The Relation of Bacteriology to Clinical Medicine.* With the establishment of bacteriology as a science by Louis Pasteur (1822-95), the etiology of infectious diseases was firmly established. Fracastorius in the sixteenth century had prophesied the relation of micro-organisms to disease; van

Leeuwenhoek had seen them in 1687; J. L. Schönlein (1793-1864) in 1839 had described the parasite responsible for favus, and anthrax bacilli had been described by C. Davaine (1863). But Pasteur by accurate methods made the specific character of diseases certain, finally disproved spontaneous generation, the occurrence of which had been controverted long before by F. Redi in the seventeenth century and by Lazzaro Spallanzani (1729-99), and thus provided Joseph Lister (1827-1912) with the sure basis for antiseptic surgery and efficient sterilization. His recognition of streptococci was followed by a fall in puerperal infection in Paris. His protective vaccination against anthrax and other infections culminated in the treatment, by the attenuated virus, of persons in the incubation period of hydrophobia, with the result that among nearly 45,000 persons treated in thirty-six years the mortality was 3 per thousand only. Robert Koch (1843-1910) worthily seconded Pasteur and by developing the technic of special culture media and stains discovered the tubercle bacillus (1882), the cholera vibrio (1883), and, through his pupils, Gaffky, who isolated the typhoid bacillus (1884), Loeffler the diphtheria bacillus (1884), Kitasato the bacilli of tetanus (1889) and of plague (1894), and others, altered the face of medical knowledge. The discovery and isolation of bacterial toxins led to the successful antitoxic serums for the treatment of, and later for protection against, tetanus and diphtheria (von Behring, 1893). The science of immunology, including the problems of anaphylaxis (C. Richet, 1909), followed and provided diagnostic serological tests for infection, such as



the agglutination reactions for enteric (Widal's reaction), undulant and other fevers, complement deviation tests, such as the Wassermann reaction for syphilis (1906), and cutaneous tests for sensitization, such as Pirquet's for tuberculosis and those for asthma. The Schick test for the detection of susceptibility to diphtheria (1911) and the Dick test on similar lines as regards scarlet fever (1923) are later developments and of value in the prevention of these infections.

Specific treatment on the lines originated by Pasteur were extended by Almroth Wright (1861- ) whose anti-typhoid vaccine (1897) was followed by general vaccine therapy. Chemotherapy, or the introduction into the host's circulation of antiseptics which kill the parasites without damage to the patient, was the ideal of Paul Ehrlich (1854-1915), the inventor of the side-chain theory of immunity; its most widely known success was the employment of salvarsan or "606" (1910) in syphilitic infection; this aimed at a *therapia magna sterilans*, the *Treponema pallidum*, discovered by Max Schaudinn (1871-1906) in 1905, being thus destroyed. The recognition of ultra-microscopic or filter-passing viruses dates from Loeffler and Frosch's observations on foot-and-mouth disease in 1898, and a large number of diseases have now been shown to be due or ascribed to their activity. The application of bacteriology to the experimental investigation of epidemics of infective disease has recently been studied by Simon Flexner (1863- ) at the Rockefeller Institute of Medical Research, and by W. W. C. Topley (1886- ) with the collaboration of the expert medical statistician Major Greenwood (1880- ).

Protozoology and the importance of insect "carriers" of disease have modified clinical medicine, especially preventive and tropical practice, in an extraordinary manner. For the latter we are indebted to Theobald Smith (1859- ) who in 1889 showed that cattle ticks transmit the virus of Texas fever. A. Laveran (1845-1922) discovered the malarial parasite in 1880, and in 1898 Ronald Ross (1857- ), stimulated by Patrick Manson (1844-1922), the Father of modern tropical medicine, to work on the analogy of his demonstration in 1878 that filarial disease is transmitted by the culex mosquito, proved that this mode of transmission holds true for malaria. Walter Reed (1851-1902) showed in 1901 that the *Stegomyia* mosquito (*Aedes aegypti*) is the vector of the yellow fever virus, and thus established the truth of this suggestion made by J. C. Nott (1804-73) in 1848, by C. J. Finlay (1833-1915) in 1881, and, also as regards other diseases, by L. D. Beauperthuy (1807-71) in 1854. Various anti-mosquito measures were therefore actively undertaken to prevent malaria and yellow fever; the most remarkable demonstration of how the tropics can be made safe for the white man was the successful completion of the Panama Canal, situated in one of the most unhealthy parts of the world, as the result of the sanitary organization of W. C. Gorgas (1854-1920). The International Health Division of the Rockefeller Foundation has successfully continued and extended the preventive campaign against malaria, yellow fever, and other infective and parasitic diseases.

*The Constitutional Factor in Disease.* The influence of the individual's constitution or

make-up in the incidence of disease was recognized in the physical type prone to chronic pulmonary tuberculosis and the "humors" of Hippocratic times. In the middle of the nineteenth century diathesis or the inherent tendency to certain diseases was prominent in medicine (T. Laycock, 1862; J. Hutchinson, 1884). The rise of bacteriology relegated this conception for a time to comparative oblivion as an unsubstantial phantasy. But the now obvious truth that disease does not depend only on exogenous factors, such as microorganisms and poisons, but is also determined by endogenous conditions or the "soil" soon reasserted itself; Hueppe in 1893 led the reaction against the exclusive importance of the "seed," and this was aided by the new knowledge of heredity due to Charles Darwin (1809-82) and to G. J. Mendel (1822-84) whose work, though published in 1865 in a rather inaccessible journal, was not confirmed and brought to general notice until 1900 by H. de Vries and by William Bateson (1861-1926) in 1902. Mendelian methods, or the analytical observation of specific characters in the individual and their occurrence in the immediate offspring, have been much employed in the modern study of heredity. The conception of constitution includes hereditary variation from the average not only in structure but in function, and of the latter the inborn errors of metabolism or chemical malformations, as A. E. Garrod (1857- ) has happily called them, such as alcaptonuria, cystinuria and pentosuria, are good examples. The anthropological clinic of F. Kraus (1897) at the Charité in Berlin and the work of F. W. A. Martius (1914) on constitutional disease



were followed by G. Draper's description of bodily conformations which specially dispose to certain diseases, such as tuberculosis, peptic ulcer, gall-bladder affections, pernicious anemia, and asthma, such types being as distinct as those of the races of mankind. The study of human biology by Raymond Pearl (1879- ) of Baltimore and others promises to advance the knowledge of the part played in disease by the constitutional factor.

*Vitamins* or accessory food factors, which are necessary for growth and health, so that their absence is responsible for deficiency diseases or avitaminoses, such as rickets (vitamins D and/or A), beri-beri and pellagra (vitamin B), and scurvy (vitamin C), have become increasingly important during this century, due to the researches of C. Eijkman (1897) of Utrecht, Gowland Hopkins (1906) of Cambridge, England, J. Fraser and A. T. Stanton (1908), C. Funk (1911), J. Goldberger (1915), E. V. McCollum and others.

The last eighty years or so may thus, as H. A. Christian pointed out, be roughly divided into three periods of about twenty-five years each according to the predominant line of research underlying the practice of clinical medicine. Thus (1) the third quarter of the nineteenth century was preeminently that of morbid anatomy and of the intensive study of physical signs; (2) the last quarter of the last century was remarkable for the influence of etiology due to the activity of bacteriologists and the use of the experimental method, and (3) this century has seen the investigation of disorders of function: metabolism and biochemistry, in the most prominent place.

These periods are of course in no way sharply defined or characterized by exclusion of the influences previously or subsequently most powerful. Investigation of the first evidence of departure from health or the earliest stages of disease, before gross structural changes have occurred, is difficult and necessitates examination not only of the efficiency of the patient's functions, such as can be done by various laboratory tests now available, but of their environment, such as can be carried out by a scheme of social service and follow-up system introduced by R. C. Cabot in 1905 at the Massachusetts General Hospital, Boston, or by health visitors. Investigation of the earliest stages of disease is part of the problem of preventive medicine, and was the object of the St. Andrews Institute for Clinical Research founded by James Mackenzie in 1918, and now called after him. To take but one example, research workers in laboratories all over the civilized world are engaged in the search for the cause of malignant disease, but so far this basis for its prevention and cure has not been discovered.

*Clinical Medicine in the Nineteenth Century.* In addition to those already mentioned in connection with physical signs the Paris school early in the nineteenth century was rich in clinical teachers: A. F. Chomel (1788-1858), Gabriel Andral (1797-1876), and P. C. A. Louis (1787-1872) who, following the suggestion of P. S. Laplace (1749-1827) the astronomer, introduced the numerical or statistical method of studying disease, overthrew Broussais' (1772-1838) modification of the Brunonian theory of irritation, and showed the fallacy of excessive venesection,

then so fashionable in Paris under the leadership of Broussais and Bouillaud (1796-1881). The recent study of statistics and the application of biometric methods by Karl Pearson (1857- ) and his followers created a new school of research and has thus thrown light on some of the most difficult problems of epidemiology and etiology. P. P. Bretonneau (1771-1862) of Tours described diphtheria and enteric fever. The infective nature of tuberculosis was proved by J. A. Villemin in 1865-8 and by W. Budd in 1867. Later Armand Trousseau (1801-67), who was a pioneer in tapping pleuritic and pericardial effusions, insisted on bedside observation and, like his teachers Bretonneau and Pasteur, on the specific nature of diseases. The teaching of the Paris school in physical signs and morbid anatomy spread widely to other countries.

In Dublin the torch of Parisian medicine was brilliantly kept alight by R. J. Graves (1796-1853) and William Stokes (1804-78) whose names, with those of R. Adams (1791-1875) and Dominic J. Corrigan (1802-80), are familiar in connection with new diseases or syndromes. Exophthalmic goiter had been observed in 1786 by Caleb Hillier Parry (1755-1822) of Bath and it was described by Flajani (1800), Graves (1835), and Basedow (1840). Stokes' treatise "Diseases of the Heart and Aorta" was on the same lines as those written in London by James Hope (1801-41), C. J. B. Williams (1805-89), W. H. Walshe (1812-92), and W. H. Broadbent (1835-1907); later the advances made with the help of the polygraph, based on the graphic method employed from 1860 by E. J. Marey (1830-1901) and James



Mackenzie (1853-1925), and of the electrocardiograph, by W. Einthoven (1860-1927) of Leyden, the inventor of the string galvanometer, K. F. Wenckebach (1864- ), and Thomas Lewis (1881- ) revolutionized cardiology.

In Vienna the example of Paris was followed by Carl Rokitansky (1804-78) from the morbid anatomical and by Josef Skoda (1805-81) from the clinical point of view, the latter criticizing Laënnec's interpretations, but making anatomical diagnosis the important method of clinical medicine. Hermann Nothnagel (1841-1905), at a later date, was also a prominent teacher, especially of neurology. In Germany J. L. Schönlein (1793-1864) of Berlin followed Laënnec's methods and, by insisting on chemical analysis and other methods, founded the modern clinical teaching in that country. C. R. A. Wunderlich's (1815-77) laborious study of clinical thermometry (1868) was an important stimulus to its modern use. As long ago as 1638 Sanctorius had constructed a clinical thermometer, as did du Val of Paris in 1684; Van Swieten (1700-72) and Anton de Haen (1704-76), the founders of the Vienna school, made clinical observations with Fahrenheit's mercurial thermometer, and George Martini (1740), James Currie (1799), G. Andral (1841), John Spurgin (1852), John Davy (1863), and Sidney Ringer (1865) published numerous observations; but it was not until Clifford Allbutt in 1867 invented the present short form of clinical thermometer that the taking of temperatures became a routine practice. Wunderlich, following the physiologists Johannes Müller (1801-58) and François Magendie (1783-1855), introduced

the idea of physiological medicine, namely that disease is only disordered physiology, and thus counteracted the German idea of "Naturphilosophie" and the anatomico-pathological view of medicine adopted by Virchow and Traube. This was followed by more attention to symptoms and metabolism by von Frerichs (1819-85), von Leyden (1832-1910), and B. Naunyn (1839-1925), and to the diagnosis of disorders of function; for example Adolf Kussmaul's (1822-1902) introduction of the stomach pump\* in 1867 was followed in 1875 by the use of the stomach-tube and test meals by C. A. Ewald (1845-1915), a method of diagnosis much elaborated in recent years. Metabolism in various aspects was advanced by Justus von Liebig (1803-73) from a purely chemical point of view, and in application to medicine by O. Rosenbach (1851-1907), Max Rubner (1854- ), Fr. Müller (1858- ), C. von Noorden (1858- ) and many others.

One of the first great contributions to medicine in North America was the recognition and adequate description of hemophilia by J. C. Otto (1774-1844) of Philadelphia in 1803. The teaching of the Paris school exerted very considerable influence on American medicine during the first half of the nineteenth century. W. W. Gerhard (1809-72) of Philadelphia had studied typhoid fever with Louis and so in 1837 differentiated it from typhus, thus preceding William Jenner (1815-98) in 1847. The great development of medicine in

\* A nasal tube was used by Baron Larrey in 1798; Philip Syng Physic (1768-1837) of Philadelphia washed out the stomach with a tube in 1812, and Jukes invented a stomach tube in 1822.

North America in the last quarter of the nineteenth century coincided with William Osler's (1849-1919) activities at The Johns Hopkins Hospital, Baltimore (1889-1905), and must be largely ascribed to his energy and ideals which his former pupils when becoming professors and teachers carried to other medical schools.

The distinguished trio at Guy's Hospital, London: Bright, Addison and Hodgkin, in the middle of the nineteenth century did much for clinical medicine by describing, and stimulating research into, new forms of disease. Richard Bright (1789-1858) in 1827 definitely correlated nephritis with its clinical manifestations, thus completing previous scattered observations, such as those of William Saliceto who in 1476 described dropsy in association with contracted kidneys, of albuminuria by Frederik Dekkers of Leyden in 1694, by W. C. Wells (1757-1817) of London in 1811, and John Blackall (1771-1860) of Exeter in 1813. Bright also started teamwork on renal disease in 1842, and advanced clinical medicine in many other directions. George Johnson (1818-96) working on the arterial changes, and W. W. Gull (1816-90) and H. G. Sutton on arterio-capillary fibrosis (1872), further advanced Bright's work on renal disease. The estimation of arterial blood pressure, begun experimentally by Stephen Hales (1677-1761) in 1723, was employed clinically by F. A. Mahomed (1849-84) in 1874 and by von Basch in 1880, and was popularized by Clifford Allbutt (1836-1925) (who insisted on hyperpiesia or high blood pressure apart from renal disease), Lauder Brunton (1844-1916), T. C. Janeway (1872-1917), and many others. Thomas



Addison (1793-1860), another of the Guy's Hospital trio, investigated pernicious anemia and in so doing discovered in 1855 the disease of the suprarenal capsules which bears his name; though the speculative Théophile de Bordeu (1722-76) had some conception of internal secretions in 1774, this was the first established disease of the endocrine glands, and with the physiological work of Claude Bernard (1813-78) and C. E. Brown-Séquard (1817-94) stimulated similar investigations; Gull gave a clinical description in 1873 of myxedema; K. Minkowski and von Mering's work on the internal secretion of the pancreas (1889) was crowned by the insulin treatment of diabetes mellitus (Banting and Best, 1921); and acromegaly, described by P. Marie in 1886, was shown to be due to disordered secretion of the anterior lobe of the pituitary. More recently the chemical constitution of some of the active principles, such as adrenalin and thyroxin, has been determined, and they have been made synthetically. The internal secretions of the adrenals, thyroid and pituitary are specially connected with the vegetative nervous system and resemble the digestive hormones described by E. H. Starling (1866-1927) and W. M. Bayliss (1860-1924). These secretions have largely taken the place formerly ascribed to the "humors" and also to some extent the part once thought to be played by disordered nervous reflexes. Diseases due to lack of an internal secretion can in some cases, such as cretinism and myxedema, be kept in abeyance by administration of the necessary secretion; and a most striking example of preventive medicine is the prevention of endemic goiter

by small doses of iodine (D. Marine). Research on pernicious anemia has progressed; from 1888 onwards W. Hunter insisted on its septic origin; A. F. Hurst has emphasized the importance of achlorhydria, and in 1927 Minot and Murphy brought out the liver treatment which ranks with insulin as one of the greatest modern advances in treatment.

Thomas Hodgkin (1798-1866), the third of the trio and pathologist at Guy's, reported cases of the condition now known as Hodgkin's lymphogranuloma (1832), which Samuel Wilks (1824-1911), who was among the pioneers in describing visceral syphilis (1857), loyally called after his predecessor; Rudolph Virchow (1821-1902) described this condition as lymphosarcoma, and in 1845 independently of Hughes Bennett (1812-1875) of Edinburgh gave the account of leucemia. Knowledge of diseases of the blood-forming organs was greatly advanced by Paul Ehrlich, the "founder of hematology," whose staining methods (1877) differentiated the various cells in the blood and thus elaborated the cellular pathology founded by Virchow in 1858. The developments in *physiology* in the nineteenth century were closely associated with clinical *neurology* and the two studies mutually influenced and stimulated each other. The distinction between the motor anterior and the sensory posterior nerve roots from the spinal cord was finally proved in 1811 by Charles Bell (1774-1842). In 1833 Marshall Hall (1790-1857) established the difference between a voluntary act and the unconscious reflex action previously recognized by Descartes; this subject has since been much

expanded by L. P. Pavlov (1849- ) in conditioned reflexes, by C. S. Sherrington (1857- ), J. Babinski, and others. John Hilton (1804-78) in "Rest and Pain" (1863), an anatomicoclinical study, somewhat anticipated James Mackenzie's view that symptoms are disordered reflexes. In 1861 Paul Broca (1824-80) showed that aphasia, or loss of speech from inability to translate thought into the spoken word, was associated with a lesion of the left third frontal convolution, a conception now disputed. In 1870 J. Hughlings Jackson (1834-1911) published a number of cases, as Bravais had previously done in 1824, of localized lesions in the brain associated with convulsive attacks without loss of consciousness, the syndrome known as Jacksonian epilepsy. F. G. Gall (1757-1828) and J. C. Spurzheim (1776-1832) had in their work on phrenology (1810-19) in some degree foreshadowed localization of function in the cerebral cortex. The observations of Broca and Hughlings Jackson stimulated experimental investigation into the localization of function in the cortex by G. Fritsch (1838-97) and E. Hitzig (1838-1907) in 1870, L. Goltz (1834-1902) in 1874, David Ferrier (1843-1928) in 1874, Sharpey-Schafer (1850- ), F. W. Mott (1853-1926), C. E. Beevor (1854-1908), Victor Horsley (1857-1916), and others.

Clinically neurology was much advanced by J. M. Charcot (1825-93), his pupil Pierre Marie (1853- ), by G. B. A. Duchenne of Boulogne (1806-75), W. H. Erb (1848-1921), S. Weir-Mitchell (1829-1914), W. R. Gowers (1845-1913). Horsley and Harvey Cushing (1869- ) by



experiment and by operative skill in removing cerebral and spinal tumors added much to existing knowledge of neurology. The details of the nervous supply of the vascular system and the viscera were worked out by W. H. Gaskell (1847-1914) and J. N. Langley (1852-1925) and provided a clear basis for the rational advance of medicine; Gaskell's work on the heart was applied with great effect by James Mackenzie and K. F. Wenckebach in the growth of the new cardiology.

*Hypnotism*, which had been exploited in 1779 as "animal magnetism" by F. A. Mesmer (1734-1815) in Paris, was seriously investigated by Charcot at the Salpêtrière in Paris though the results there were somewhat dramatic and probably vitiated by deception, and also by the Nancy school under A. A. Liébault (1823-1904) and H. Bernheim (1840-1919), where suggestion and later autosuggestion under Emile Coué (1857-1926) were mainly employed. This led up to the intensive study of morbid psychology and the modern practice of psychotherapy. Sigmund Freud (1856- ) of Vienna and C. G. Jung (1875- ) of Zürich were active in developing the conception of the morbid influence exerted by the unpleasant experiences actively forgotten or repressed in the unconscious. The detection and removal of such disturbing factors were effected by analysis of the dreams *via* the patient's "free associations"; this technic of psychoanalysis is based on the assumption of an elaborate system of symbols. This was an undoubted advance; but the concentration of Freud and his followers on a sexual factor, especially in early life, to the practical exclusion of other forms of psychical trauma,

such as that of the instinct of self-preservation (subsequently proved in the war to be important) militated against the general acceptance of the valuable conception that an irritant in the unconscious was the factor responsible for a conflict and so for neuroses and psychoses. Experimental psychiatry was developed by Emil Kraepelin (1856-1927), and the biological aspects of mental disorder have been studied by P. E. Bleuler (1857- ), Hoch in Germany, and by Adolf Meyer (1866- ) of The Johns Hopkins Hospital. Neuropathology owes much to F. W. Mott. The mental hygiene movement is a valuable prophylactic in connection with insanity.

A return to the Hippocratic methods of improving the healthy condition of the body by Nature's remedies was made in the nineteenth century and after. The *open-air treatment of tuberculosis* was carried out by George Bodington (1799-1882) of Sutton Coldfield, Warwickshire, in 1840, by Henry MacCormac (1800-60) of Belfast in 1855, H. Brehmer (1826-99) in Silesia in 1859, E. L. Trudeau (1848-1915) in the Adirondacks in 1884, Otto Walther at Nordrach, and others. Tuberculosis sanatoria became common at the end of the century, and since the Great War Village Settlements or permanent colonies for the tuberculous, such as that organized by P. C. Varrier-Jones (1883- ) at Papworth, near Cambridge, England, have been started. The old sun-cure was revived, especially by A. Rollier at Leysin in 1903, for surgical tuberculosis, in which it has largely taken the place of surgical operations. Artificial heliotherapy or actinotherapy has since come into vogue.

*Specialism.* In Egypt during the fifth century B.C., as already mentioned (p. 5), each practitioner rigidly confined his activities to one disease; this, however, was an isolated phase. In the second half of the nineteenth century the enormous advance of medicine and the practical application of the ancillary sciences resulted in the legitimate growth of specialism, which indeed had been foreshadowed at the beginning of the century by the establishment in London of hospitals for special diseases, such as the Royal Ophthalmic Hospital (1804) and the Royal Ear Hospital (1814). For a long time the leaders of the profession opposed specialism, and until the beginning of the present century the special departments of the great teaching hospitals in London were usually in charge of general physicians or surgeons on the staff of the hospital, the need for a specialty being thus admitted but with a compromise to prevent the creation of whole-time specialists. The case for specialism has now been universally recognized, and, as a result of the intensive study thus made possible, knowledge has grown rapidly and the standard of technical skill has greatly improved.

This decentralization and cleavage of medicine into separate compartments has necessitated a system of teamwork, which has long been an essential part of large hospitals for the poor. The principle of combined investigation of the patient by a group of specialists accustomed to work together was systematically adopted and carried to its logical conclusion at the Mayo Clinic, Rochester, Minnesota, and its phenomenal success has naturally led to its imitation in private



practice (group-medicine and diagnostic clinics) so that the well-to-do can obtain the same advantages as the poor receive in hospitals.

As in practice so in teaching the expansion of knowledge has resulted in the establishment of specialist whole-time teachers in the ancillary sciences; at present, however, the plan of whole-time teachers of medicine, surgery, and obstetrics, though adopted and on trial in a number of medical schools, is far from being so universal as in the case of the professors and teachers of the pre-clinical sciences.

The present century has seen far-reaching *organization and endowment of medical research*, which has already influenced clinical medicine in important ways. The Rockefeller Foundation in New York is an outstanding example with its motto "The Well-being of Mankind throughout the World"; in Great Britain the Medical Research Council has enabled a large number of men who otherwise could not afford to give their whole time to research work to do so without distracting anxiety. More than ever before have generous endowments been made by public bodies and by private donors, so that the opportunities for original work have greatly increased. Formerly researches advancing medical knowledge were largely due to individual and isolated effect; but now teamwork has become more general and prolific. Medical education, undergraduate and postgraduate, has recently attracted most serious consideration, and as a result much modification, organization, and improvement have followed. New and important observations are being made in steadily increasing numbers.

If these can be properly sifted and incorporated into the sum of medical knowledge, internal medicine will profit perhaps most of all of the branches of the medical Art and Science.

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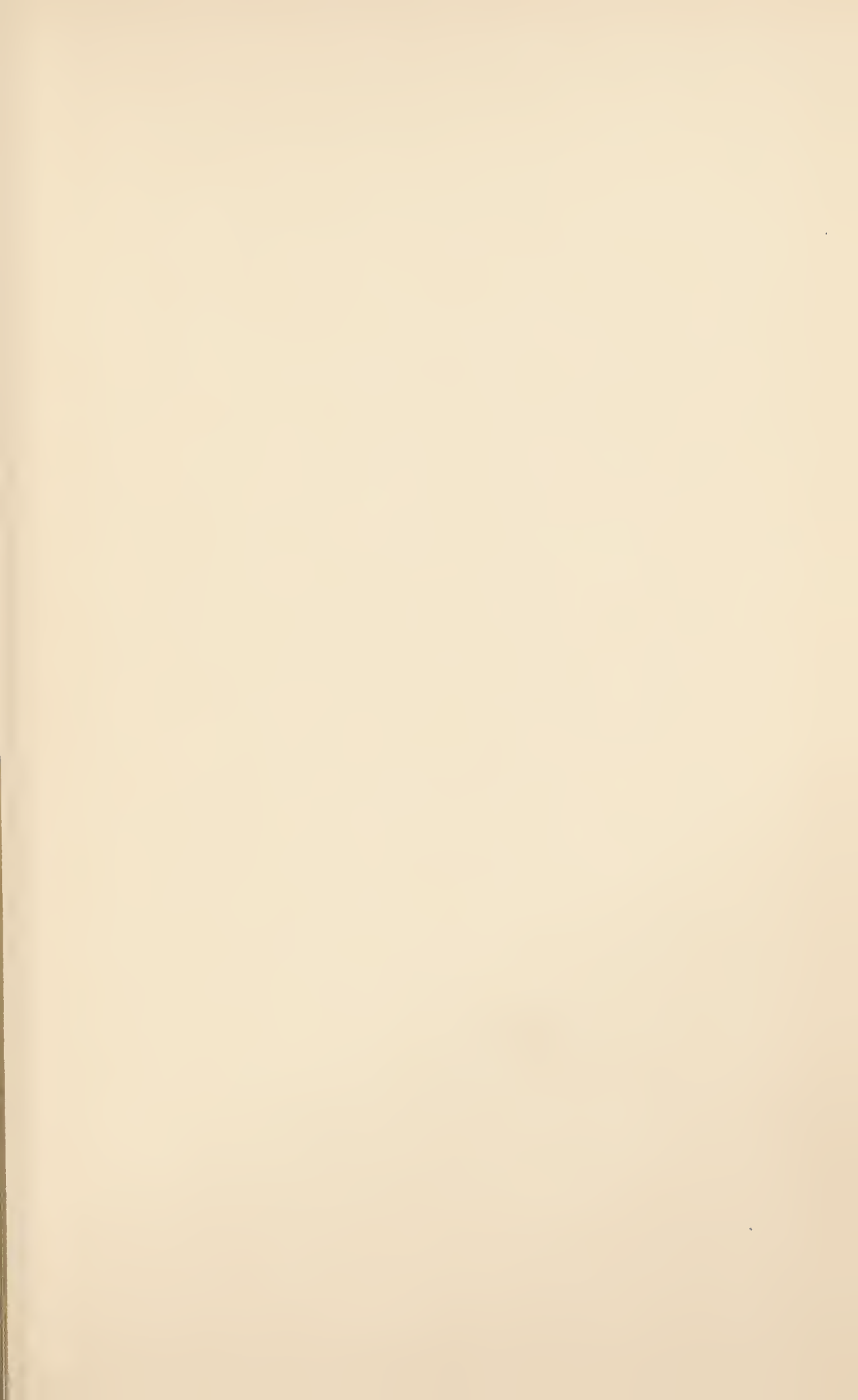
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